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A LESSON FROM CHICAGO.

In another column a brief account is given of the gas situation in Chicago at present, where a popular outcry has been made for a cheaper gas rate, and a campaign of education has been begun by the gas company to educate that part of the gas-using public which is on the "kickers' seat" to the fact that poorly kept gas appliances, rather than poor gas, are responsible for most of the dissatisfaction from alleged poor gas. The company is spending a good deal of money at present advertising the fact that it maintains a "special order department," which makes it a business to put gas appliances in proper shape, free upon request, of any customer. There are two lessons in all of this, that should not be lost upon electric light or gas companies. First: Do not wait until there is talk of reducing rates, municipal ownership or the giving of a franchise to a competing company before you take up a movement, such as has been started by the gas company in Chicago. Second: Do not imagine that the duty of the central station company ends at the customer's service switch. It may end there legally, but practically, and in a business way, the customer judges by the results that the lamp or motor or heating device give. Even when these latter devices belong to the customer, the company should see to it that they are working properly. While it is, of course, not feasible for the company to do extensive repairs free, it can—by advertising the fact among its customers, that it stands ready to see that they are getting the best results from the apparatus employed—do much to prevent a bitter feeling against the company. It is this problem of insuring good results to the customer, that has resulted in the adoption of the plan of free lamp renewals, by so many of the large central station companies. The presence on the line of dim, inefficient lamps, purchased by the customer from dealers selling such lamps on the strength of their long life, is sure to result in so much dissatisfaction with the electric light service that the large companies have almost been forced to take this matter out of the hands of the customers entirely and offer free renewals, using high-efficiency lamps —thus insuring against dissatisfaction in this respect. The customer is interested in the results only, and the results are what the company should use every effort to give.

CIVIL ENGINEERS AND OTHER ENGINEERS.

At the annual meeting in January of the American Society of Civil Engineers, the following amendment to the constitution of that society will come up for discussion: "A member shall be a civil engineer who shall have reached a position of recognized standing in the profession, in its several branches, including Military, Naval, Mining, Mechanical and Electrical Engineering, or in Architecture or Marine Architecture." The punctuation and placing of the additive and alternative particles render the meaning of the proposed amendment somewhat obscure. Under one construction the intent would appear to be to divide civil engineers into three classes, namely, architects, marine architects and engineers who combine the qualifications of army, naval, mining, mechanical and electrical engineers. Until man advances in mental capacity to a point that the great range of scientific and engineering knowledge implied in the third grouping can be encompassed by one mind, the effect of the proposed amendment, as thus construed, would appear to limit future membership in the Civil Engineers to architects, shore and marine. According to another construction, electrical engineers and the other classes of engineers enumerated are to be considered also civil

engineers and as such welcome into the society. If the real object is to make membership in the Civil Engineers as inclusive as this construction implies, might it not best be attained by petitioning the American Institute of Electrical Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and other bodies affected, to give up their respective organizations and deliver *en bloc* their members to the Civil Engineers? Finally, in view of the growing frequency of the inquiry, "What is a Civil Engineer?" would it not be well, instead of involving in still greater obscurity the significance of the term, to define it clearly with reference to the actual work of civil engineers, and not, by implication, with reference to the work of other classes of engineers? Are some members of the Society of Civil Engineers ashamed of the ancient and honorable occupations of transit squinting, ditch digging and track laying?

Belt Transmission of Power as an Analogue of Electric Transmission.

There is a fascination about the electric transmission of power which is attributable to its invisibility. When power is transmitted by a rope or belt drive, we see the moving parts, we can feel the tension, and we can readily apprehend the process. When power is transmitted by a moving fluid, as in pneumatic or hydraulic systems, our senses again come to aid our imagination and we can form an adequate mental picture of the process. When, however, we contemplate the electric transmission of power, our senses are unresponsive and powerless to suggest. We enter an electric generating station. If it be a steam plant, we see the coal fed steadily into the hungry furnaces. The boilers are hard at work producing steam under pressure. This compressed steam rushes in a swift stream to the admission valves of the engines, carrying the energy with it, and the transmission of power from boilers to engines is perfectly plain. We see the engines, be they reciprocating or rotary, transforming the exhaustive power of steam into the power of moving machinery. Moving stresses in gaseous media exchange into moving stresses in the solid media. Or, if the generating plant be hydraulic, we can see the moving water falling through the turbines and delivering its power into the electric generators. But by whatever path we reach the generators, the process seems to end there mysteriously, like a river that loses itself in an underground passage to the sea. The dynamos are tugging at their load, and beyond them are the quiet line conductors, apparently carrying all this power without disturbance, save a slight rise in temperature. Nothing is to be seen, felt, smelled or heard of the transmitted power till we come to the motors at the distant end of the line. There seems to be no electrical wear and tear, or depreciation, in the conductors. Insulators may be fractured, but the copper or aluminum bids fair to outlive time, save for the erosion of the elements. Curiously enough, in spite of our inability to form an adequate mental portrait of the process of electric power by mechanical means we understand practically how to control and carry on the process. It is an open question whether we should be better enabled to transmit power electrically if we thoroughly understood the process. It is questionable if our plants would be any cheaper, or more durable, or more convenient. In the ante-Galileo days, it was supposed that a pump sucked up and raised water because Nature abhorred a vacuum, although it was a hard task to find why the abhorrence should cease at a depth of thirty-two feet. The significant fact was rather that men are distressed at not comprehending a well known phenomenon, and will often invent a fictitious reason rather than admit total ignorance. Thus, we in this age, pending the full elucidation of the phenomena of electric power transmission, seek to allay the pangs of mental hunger by bridging the gap of emptiness with analogies.

The article by Prof. Brackett on page 986 of this number draws attention to the difficulty which is presented by the various analogues of electric power transmission in current use. The hydraulic theory which pictures the electric conductor as a water-pipe is shown to be very defective, as indeed all admit. Prof. Brackett goes on to develop an analogy between the electric transmission and the belt drive. This has been suggested before in outline, but Prof. Brackett carries the analogy to a degree of detail that probably has not been hitherto attempted. The inertia of the belt and of the mechanical parts connected thereto is considered as analogous to the electromagnetic inertia. The elasticity of the belt is considered as analogous to the electrostatic capacity of the electric system. It is shown that the fundamental electric and magnetic equations of the electric transmission system may be read upon the mechanical properties of the belt transmission system when the meaning of the symbols is changed from electromagnetic to mechanical quantities. Interesting and remarkable as this analogy is when carried into detail, doubt exists as to the benefit to be derived from pursuing it. To one not acquainted with all the mechanical principles involved, it would perhaps be quite as simple to study the phenomena direct instead of by analogy. As indicated in the article, it can only remain an analogy and can no more become a real working theory of the electric transmission circuit than the hydraulic analogy. This is evident when we consider that in the belt transmission, the power is carried in the belt substance and not in the surrounding air. Whatever power wanders into the air, or the space surrounding the belt, is lost for the purposes of transmission and is frittered away in heat. On the other hand, in the electric transmission, the power is carried in the ether, or space surrounding the conductor, and not in the substance of the conductor. Whatever power wanders into the conductor is lost for the purposes of transmission and is frittered away in heat. Consequently, the belt drive and the electric drive, although in many details analogous, are actually antithetical as regards the location and space distribution of the moving energy.

While, therefore, mechanical analogies of the electric drive may be very interesting to examine, and while they may temporarily fill an aching void in our understanding of the immediately surrounding universe, we must hope for permanent satisfaction from a closer physical development of the actual phenomenon. The better we understand any working of Nature, the simpler it appears, and we have a right to hope, if not to believe, that the true inwardness of the electric transmission circuit would be extremely simple if we could only gain an insight into it. We already know that the energy in an electric drive is carried half by electric flux and half by magnetic flux, the two fluxes being inseparably associated and moving together crabwise at right angles to their directions, with the speed of light in the medium considered. We know that the electric and magnetic fluxes contain energy as a necessary property, this energy per unit volume varying as the square of the flux density. Where the fluxes are, there, too, are the flux energies, and when the fluxes skim over a wire at light speed they carry their energy with them. It is not yet known whether the ether itself moves, or whether the ether is steady but the fluxes move through it. It is not yet known what change is needed to produce a flux in the ether; whether it be a hydrostatic stress, or a movement like that of a vortex filament. But it is known that whatever the nature of one flux is, the other will be its curl. It would seem, therefore, as though we might receive experimental demonstration on these moot points before long. When such demonstration is completed we expect to claim an understanding of the electric drive; but even then, it may be difficult for us to form a mental picture of it, so based are all our mental pictures upon sensation memories. Perhaps we may need an analogy to think about, even then.

THE ZAMBESI POWER SCHEME.

As we have recently noted, the great scheme for the utilization of Victoria Falls is again before the public with perhaps some prospect of being pushed to a finish. A species of prospectus published in *South Africa*, of London, has just reached us, and though somewhat flamboyant in its contents still bears witness that something may be accomplished. The best evidence we have yet seen is that the promoters have taken counsel with an American electrical transmission engineer regarding the matter instead of relying, as in the previous incarnation of the project, upon the somewhat theoretical advice of academic gentlemen whose chief acquaintance with dynamos had been gained in distribution at about 100 volts. The Victoria Falls project is certainly a notable one. The great cataract of the Zambesi is one of the very few really enormous hydraulic powers of the world. Perhaps the only others in the same class are Niagara and that tremendous fall on the Parana which has recently been reported. But, unlike Niagara, Victoria Falls has at present no market within several hundred miles, and the Rand, the objective of the present scheme, is 700 miles away across the African wilderness. The concrete proposition is the feasibility of competing at the end of such a transmission with power generated by steam or gas engines on the spot or within the scope of an easy distribution. As a mere engineering feat the transmission of the power presents no forbidding difficulties. Half of this distance has actually been covered in California, and with only 50,000 volts pressure at that. But the probability of dividends is quite another matter, and one of far more dubious issue.

The long and short of the matter is that good financial returns are quite out of the question at or near any voltage yet attempted. This is by no means a damnatory judgment—it merely indicates that the engineers must be prepared to invade and conquer territory hitherto unexplored. Even at 100,000 volts working pressure and 20 per cent loss the project from the financial standpoint has a rather sorry aspect, but it is fair to presume that the engineers do not intend to halt at that figure any more than they propose to rest content with transmitting 20,000 hp. It must be remembered, however, that increase of output without increase of voltage does not help the matter much since the capital cost increases nearly *pro rata* in cases where so large a proportion of expense is in the line. An almost fantastic touch is given the project by the serious consideration of Thury's direct-current system as a possible method in the case. We have great respect for M. Thury's skill and ingenuity in working out the troublesome problems of direct-current series transmission, but in view of the enormous voltage required to make a success commercially on a 700-mile line, and the small output of even the largest dynamos yet constructed for series transmission, we may be forgiven for refusing to take the direct-current proposition very seriously. We are quite willing to concede that the Thury system has a useful field and possesses some very meritorious features. Since, however, the experience already gained on the Pacific Coast shows clearly that the difficulties inherent in alternating-current transmission over big distances have been greatly overestimated, and since lightning, the most formidable enemy of transmission lines, is no respecter of systems, we fail to see the usefulness of going to a direct-current transmission. Undoubtedly the alternating current has for a given effective voltage to struggle against a higher normal voltage at the sine-curve peak, but on the other hand, it has to face no greater maximum strains since a direct-current line is immune as regards neither lightning nor surging. Perhaps the most important advantage which the advocates of the Thury system would claim for the series direct-current transmission scheme is not to be found in the initial saving in conducting material, but in the relative ease with which the current can be maintained constant as compared with the difficulty that is encountered with the voltage regulation of the so-called constant-potential circuits. To what extent this latter characteristic of the system may have been the determining factor in the selection of the several Thury systems now installed is difficult to surmise.

We understand that M. Blondel is looking into the question of respective insulation limits of alternating and direct-current systems, and shall await with interest his conclusions, not unmindful, however, of a certain probability that by the time they are available similar tests on a commercial scale will probably have been successfully concluded here. To make a successful commercial enterprise of a 700-mile transmission, a working pressure of 150,000 to 200,000 volts should be available in order to keep the investment in lines down to a point where it will not be in the long run prohibitive. A great transmission plant is not an investment for to-day or to-morrow, but for many years, and it cannot afford to run so close to costs by steam power as to incur the risk of disastrous competition at an early date. Working on a scale commensurate with the proposed transmission from Victoria Falls and with cheap coal as a fuel, it is possible to generate and distribute electric power at a figure much lower than is generally supposed. The actual fuel cost in a big plant of the kind that would be installed to-day is a very small item, something like 0.2 cent to 0.3 cent per kw-hour, and much less if the plant is at the mine's mouth. This cost stops when the output stops, save for the small fraction required for banking fires, while the interest, depreciation and maintenance charges on a line go remorselessly on for every hour in the year. And this takes no account of gas-engine working on a large scale, such as is about to be tried by the California Gas & Electric Co.

We believe in electric power transmission and have no desire to pose as a "Devil's Advocate," but this Victoria Falls proposition certainly needs the services of such a functionary, and we hope that one has already been retained. We fully realize the splendid possibilities of Victoria Falls, and we realize too that Africa is to be the center some day of an immense civilization. In Africa and in South America some of the great world struggles of the next few centuries will doubtless find their stage, but in our own generation Rhodesia is not likely to become a great industrial center. So far as present hopes of dividends are concerned, the Victoria Falls project must depend almost wholly upon a great mining camp 700 miles away, at a point where there may be somewhat sharp competition from fuel. Its promoters must take all this into consideration and move cautiously. They have secured good advisers on the engineering side of the problem, who can carry the technical part of the enterprise to a finish. It is a scheme magnificent in its proportions and its possibilities, and should not incur the risk of failure from too precipitate action. Its sponsors could do no better than to devote the next year or two to experiments by its corps of engineers on a large scale. Fifty thousand pounds would be well invested if thereby the practicable limit of voltage could be pushed upwards 25,000 or 50,000 volts. For commercial success is here merely a question of voltage which can be successfully worked. A certain upper figure which can be predicted within fairly close limits means economic failure in spite of operative success; a certain other limit means success, and money spent in reaching the latter is spent in a profitable cause. We earnestly hope that the project will succeed. Its very boldness demands appreciation, and it may prove to be the forerunner of achievements far more notable than any which the world has yet seen. But to win anything more than a barren victory demands the annexation of an electrical region little known and seemingly inhospitable. It is a case for progress *à la* Kitchener with the line of communication well fortified, the commissariat ample and scouts investigating every kopje in sight.

Proposed 700-Mile Direct-Current Transmission.

A recent issue of *South Africa* (London) prints a lengthy interview with Mr. H. Wilson Fox, of the Africa Concessions Syndicate, relating to the project for transmitting power from the Victoria Falls of the Zambesi to the Rand, a distance of 700 miles. The available head of these falls is about 330 ft. and the flow is sufficient for the development of 500,000 hp. Mr. Fox stated that probably 150,000 hp would amply suffice for all the requirements of the Rand district. The present plans provide for an initial delivery of 20,000 hp, and as the demand for power becomes greater than this further independent lines will be provided.

The striking feature of the interview is the announcement that the Thury system of direct-current power transmission will be employed. Mr. Fox stated that the relative merits of the alternating and direct-current systems of power transmission had been very carefully studied. Opinions were secured from Dr. E. Tissot, of Basle, Switzerland; Prof. Gisbert Kapp, of Birmingham, and Prof. A. Blondel, of Paris, all of whom pronounced the use of direct-current transmission to be commercially feasible. Later a conference was held in London at which Prof. Kapp, Dr. Tissot and M. Thury were present, the meeting extending over three days. Conclusions arrived at favorable to direct current were formulated and subsequently endorsed by Prof. Blondel, who had been unable to attend the conference owing to illness. Mr. Ralph D. Mershon was also called on for an opinion, and upon his arrival in Europe visited with Mr. Fox the various Thury installations in Switzerland and Italy. Mr. Mershon also had lengthy consultations with Profs. Blondel and Kapp. Mr. Fox states that as a result of Mr. Mershon's visit his views relating to methods to be adopted for insulation of the lines have been accepted in a large measure; he also stated that Mr. Mershon endorsed the use of direct current for the main transmission plant.

The reasons given for the adoption of the direct-current system are, first, that at equal voltages the same power can be sent over smaller and consequently less expensive conductors; and second, that M. Thury claims that higher voltages can be employed with direct current than is practicable with the alternating-current system. It is expected that the most economic loss in transmission will, under normal conditions, be from 25 to 30 per cent. At the end of the transmission the direct current will be transformed to alternating current for distribution.

Gas Situation in Chicago.

The gas situation in Chicago is of interest to central station men all over the country, both on account of its possible influence on attempts at reduction of gas and electric light rates in other cities, and because of the campaign of education, which the gas company in Chicago is now carrying on, as a result of the attempt to reduce rates. It will be remembered the last Illinois Legislature passed a bill which gave to cities the right to regulate rates for gas and electric light. While the legality of this bill is yet to be tested, the city of Chicago, whence originated the cry for the bill, is now attempting to lower the rates, although no definite action has been taken. The gas company evidently believes that many of the complaints about poor gas and excessive bills are due to faults of the apparatus in which gas is used, and is buying large advertising space in the daily papers, in which attention is called to the fact that the gas company maintains a "special order department," for the express purpose of giving its customers, free of charge, expert service in maintaining gas ranges and other appliances at their best point of efficiency. For example, the burners in a gas stove frequently get clogged, or otherwise out of adjustment, so that it does not work properly, and the user of the stove may blame the gas company for poor gas rather than putting the blame where it belongs. The gas company will have its experts overhaul and put in proper shape any appliances in use by its customers that need such attention. It has undoubtedly been the case in Chicago that the majority of the customers have not known that such service was given free by the gas company, and have sought relief from the plumber or the maker of the gas stove, without success. The company probably believes that once the public is well acquainted with the fact that this special order department exists a great number of the complaints about poor gas and excessive rates will be done away with. The lesson this teaches the electric light companies is obvious; the customer of the central station is interested in results and he judges the company solely by the results, as he sees them, in the shape of light or power. A company should not wait until agitation for lower rates or municipal ownership or a competing company forces it to make such a move, but should as a regular practice advertise the fact that it is at all times ready to inspect customers' lighting and other appliances, to see that customers are getting what they should for the money they are paying and bills for current. It is not enough that companies deliver current at the customer's service switch and pay no more attention to what happens beyond that switch.

National Conference on Standard Electrical Rules.

At the annual meeting of the National Conference on Standard Electrical Rules, held in the Auditorium of the New York Edison Company on Monday, December 4, Mr. W. H. Blood, Jr., was elected president, and Mr. C. J. Woodbury, secretary-treasurer. Resolutions were passed requesting the National Board of Fire Underwriters to make the grounding of the secondary of low-tension, alternating-current circuits mandatory, and in the case of three-wire, direct-current systems with grounded neutrals, to make the omission of the neutral fuse permissible. It was also suggested that the present method of publishing the reports of electrical fires by the Underwriters was unfair to electric lighting interests, in that undue prominence was given to fires of electrical origin as compared with fires from other causes. Resolutions were adopted requesting the Underwriters to give all causes of fires equal prominence. It was the consensus of opinion of the conference that where alternating-current systems were grounded to gas or water pipes in dwellings near the wall and beyond the meter, no damage from electrolysis was to be apprehended. A committee was appointed to draft suitable resolutions to present to the retiring president, W. J. Hammer. A new constitution was also adopted.

The National Conference on Standard Electrical Rules was organized and held its original meeting at the American Society of Mechanical Engineers, 12 West Thirty-first Street, New York, March 18 and 19, 1896. Subsequent meetings have been held by the Code Committee of the conference, but no regular meeting of the conference as a body was held until the meeting at Boston, April 21, 1905. The new constitution provides that a yearly meeting of the conference shall be held contemporaneous with the meeting of the Underwriters' National Electric Association. The list of societies forming the present National Conference on Standard Electrical Rules is as follows: American Institute of Electrical Engineers, American Society of Mechanical Engineers, American Street and Interurban Railway Association, American Institute of Architects, American Institute of Mining Engineers, Associated Factory Mutual Insurance Companies, Association of Edison Illuminating Companies, National Association of Fire Engineers, National Board of Fire Underwriters, National Electric Light Association, Underwriters' National Electric Association, National Contractors' Association, International Association of Municipal Electricians. These societies alone may vote on changes and recommendations to the Underwriters' National Electrical Code. Associate members are made up of corporate interests such as the American Telephone & Telegraph Company, Western Union Telegraph Company, Postal Telegraph Company, General Electric Company, Westinghouse Electric & Manufacturing Company, etc.

Some Municipal Data Comparisons from England.

A study of English electrical statistics brings out some interesting points that bear upon the municipal ownership agitation. In England there are no cities of over 300,000 population supplied by private plants, except London, where the city is divided into districts. In cities of from 150,000 to 300,000 population, all except one are supplied by municipal plants.

The figures in the attached table have been obtained as follows: Population, connected load of private lights (8 cp), connected load of private motors (hp), number of consumers, and miles of main, from the London *Electrician* sheet for 1904-5. Kilowatt-hours sold

to private customers and average price to private customers from Garcke's manual; "private" customers excludes trams and street lighting.

Newcastle is the only one of these towns supplied by private enterprise, and it should be noted that in 1900 Newcastle was largely freed from the tax involved by the purchase clause, i. e., the purchase clause corresponds in its effect to the right claimed by the legislatures to regulate prices.

	Population.	Thousands of private lights, 8 cp.	Private motor H.P.	No. of consumers.	Price to public excluding tram and street lighting.	Thousands of K.W.H.	No. miles of mains.
Dublin	289,000	82	220	850	3.58	1,450	312
West Ham...	267,000	87	670	1,007	3.13	1,827	—
Dundee	163,000	72	715	1,030	3.52	1,196	—
Leicester	220,000	156	167	2,270	3.83	1,719	81
Salford	220,000	122	2,685	1,000	2.62	2,051	150
Aberdeen	165,000	107	1,871	1,321	3.65	1,581	61
Newcastle* ..	217,000	288	6,650	4,160	1.76	1,684	280
Cardiff	164,000	62	607	1,079	2.89	2,385	65
Cardiff	164,000	62	607	1,079	2.89	2,385	65
Nottingham...	239,000	206	1,913	2,704	3.86	4,168	—

* Two companies in separate district, *i. e.*, without competition.

It will be noted that when freed from the purchase clause, private enterprise has given the lowest prices, the municipal price averaging nearly 75 per cent higher. In proportion to population private enterprise supplies nearly double the number of consumers reached by the most enterprising municipality, and fully three times as many as the average municipality. Private enterprise supplies nearly as much electric energy to motors as all the eight municipalities put together; in other words, it is private enterprise that is moving to get the steam and smoke of factories away from the cities.

In the only place in England where private enterprise has been freed from the shackles of the purchase clause it has kept so far ahead of municipal enterprise that comparison is almost ludicrous. Of course one single instance does not prove a case, but it is curious that when every English municipality has had for twenty-two years all the advantages that the Newcastle Company has had for only four years, not one of them can show as good a record for the public.

Natural Gas Under Steam Boilers.

Mr. Jay M. Whitman presented at the recent New York meeting of the American Society of Mechanical Engineers an interesting paper giving the results of investigations regarding the commercial value of natural gas and coal as fuel for steam boilers. Assuming that a boiler hp-hour requires 3.5 pounds of wet coal or 45 cu. ft. of natural gas, the author finds that fuel costs are the same under best conditions with natural gas at 10 cents per 1,000 cu. ft. and semi-bituminous coal at $2.87 per 2,240 lb. Expressed otherwise, a long ton of semi-bituminous coal is the equivalent of 28,700 cu. ft. of natural gas, while a short ton of such coal is the commercial equivalent of 25,625 cu. ft. As compared with the costs for coal in a hand-fired plant having an output of 1,500 boiler hp, coal being at $2.00 per 2,240 lb.—considering the saving in labor due to the use of gas—natural gas should sell for about 10 cents per 1,000 cu. ft.

The author states that it is not justifiable to expect in good commercial practice to obtain a boiler hp-hour on less than from 43 to 45 cu. ft. of natural gas, referred to 60° Fahr. and four ounces pressure above a barometric pressure of 29.92 in. The "air for dilution" is greater with gas than with coal, so that efficiencies that are possible with coal are impossible with gas. An efficiency as high as 75 per cent in the use of gas is seldom obtained even under the best conditions.

Books Relating to Benjamin Franklin.

That part of the library of Governor Pennypacker, of Pennsylvania, which consists of Franklin imprints and books relating to Franklin, will be sold by auction in Philadelphia on December 14 by Davis & Harvey. The collection is very rich in Franklin imprints, but contains only three items relating to the scientific career of Franklin.

Four pamphlets bound in one volume are as follows: "Conjecture on the Cause of Thunder"; Paris, 1756. "Lettre electrique pur le Mort de M. Richmarnn," by A. Rabiqueau; *N.D.* Stukeley's "Philosophy of Earthquakes"; London, 1766. Lovett's "Newton's Aether Realized"; London, *N.D.* The two last-mentioned books are in the Library of the American Institute of Electrical Engineers, the date of Stukeley being 1750. On the fly-leaf of the volume the contents are written in the hand of Franklin.

Franklin's "Experiments and Observations on Electricity" is represented by the 1769 edition. The A. I. E. E. Library has four editions in English—1751, 1754, 1769 and 1774—and two editions in French—1752 and 1756.

The title of the third item is "A Poem addressed to Benjamin Franklin of Philadelphia, on his Experiments and Discoveries in Electricity." By C. W. Extracted from the *Gentleman's Magazine*, 1754.

Some Suggestive Lighting Arguments.

The excellent bulletin, "The Electric City," published in the interests of the Chicago Edison Company, prints the following list of "Don'ts for People Who Don't Use Electric Light." They may be suggestive to central station managers who are conducting active new business campaigns elsewhere:

Don't blow out the gas.
Don't sputter if the curling tongs singe.
Don't expect ironing to be a pleasure.
Don't expect hot water bags to stay hot.
Don't throw burning matches any old place.
Don't expect to keep your walls clean.
Don't knock the kerosene lamp over.
Don't complain of the odor it can't help.
Don't think your home looks modern.
Don't imagine you're enjoying life fully.
Don't let your fire insurance lapse.
Don't move into an "unwired" building.
Don't have an illuminated Christmas tree.
Don't fall down the cellar stairs in the dark.
Don't chafe at the alcohol chafing-dish.
Don't cut your throat shaving in a poor light.
Don't answer the door-bell carelessly at night without a porch light.
Don't blame some one else for all this.
Don't fail to 'phone Main 1280 about it.

Electrical Development in South Africa.

United States Consul Snodgrass, at Pretoria, Transvaal Colony, South Africa, makes an interesting report on electrical development and possibilities. He says: "Africa, both north and south, is an important customer for electrical supplies of every description, and although the British firms have been capturing the majority of contracts, due to their being on the ground floor, it is evident that the United States can come in for a larger share of the trade by the prosecution of an energetic campaign and by having competent and forcible men in the field.

"The great activity in the electrical trade is not by any means confined to South Africa, for in Egypt and other northern provinces large electrical problems are under consideration. As an instance the Soudan government is considering the introduction of an extensive electric tramway system into Khartoum. Neither cables nor overhead wires will be used, the intention being to store the electric power in the cars. It is expected that the system will be extended to Omdurman.

"In South Africa, especially in the Transvaal, the demands on electrical engineers are multiplying to an enormous extent, as the mines are running as never before since the introduction of Chinese labor. There appears to be a feeling of optimism among the little cities as well as among the larger ones, which is bringing about a large expenditure for utilities. Electrical hoists are being installed in nearly all the mines; electrical elevators are being placed in many of the business houses and in the tall buildings of Johannesburg, and in nearly every town of any importance some large electrical project is either in hand or in contemplation.

"In the city of Pretoria, a place of 30,000 people, which has come

to the front since the conclusion of the war like a boom town of the West, the citizens have been worrying along with a horse car line which penetrates the center of the city and has perhaps three miles of track. The town council is arranging to convert it into an electrical system, at an outlay of several millions, it being the intention to lay fifteen or more miles of track throughout the municipality and also to connect the numerous suburbs lying within a radius of five or six miles.

"At Johannesburg several millions were spent in installing an electric tram system, but practically all the contracts were captured by representatives from Scotland and England. At Volksrust and Klerksdorp it has been decided to erect lamps, and I might go on multiplying instances in which electrical developments are being carried on.

"If Americans care for this trade they will have to wage a war for it against the Britishers, who are on the ground and are in possession of the country. It will be difficult to wrest it from them. However, as America has captured the mining machinery trade on the Rand from all competitors, even under British rule, it can do likewise in the electrical field if the same amount of energy, concerted effort and brains are expended as were laid out by the pioneers in the gold fields."

The Proposed Manhattan Municipal Lighting Plant.

In these pages last week a very full abstract was given of the paper read by Prof. G. F. Sever before the Municipal Engineers' Society, of New York, on the proposed municipal lighting plant for Greater New York. The paper was followed by an interesting discussion, the chief points in which are noted below.

Mr. J. W. Young remarked that it would be of interest to the members to know how the data were collated for the reports of the commission. In order to design the system of distribution necessary to supply the street and building lights, the location of these had first to be obtained. The available records of the Department of Water Supply, Gas and Electricity of this city were checked and brought up to date. Inspectors were then sent through every public building, in regard to which additional information was required, and a tabulated list made of the number and character of the gas, electric lights and power equipment, in each room. Men also covered the streets to locate the different kinds of lamps, where necessary. This work took several months. The street and building lights and the location of the buildings were then plotted on large scale maps for each borough, the building lights being reduced to 16-cp incandescent equivalents.

From the number of lights thus shown on the map, the distribution of the load was evident, and the location of the main power house was obtained, and the number and economical location of the sub-stations determined; due consideration being given to the probable development of the territory.

Street circuits were laid out and their cost estimated, each being designed to carry the equivalent of fifty 2,000-cp arc lamps and two mains placed on each highway, the lamps being connected alternately on these conductors, so that if one circuit should be in trouble half of the street lights would continue to burn. The size of conductors, transformers, etc., were then calculated for the building lights, each group of buildings being carefully considered, and the economical center of distribution located in one of the larger installations, which point was fed from the main sub-station by 2,200-volt, single-phase feeders, the smaller bunches of lights being connected to a center by three-wire, single-phase conductors. All the building lights were thus connected to distributing points, except those in the immediate vicinity of the sub-station. Street lights were fed from the sub-station proper.

It was decided to place the 11,000-volt, three-phase feeders, the 2,200-volt feeders, where on the same street, and all wires in public parks, underground; in all other places, except in Manhattan and the "restricted area" of Brooklyn, overhead construction was decided upon. Pole lines were, therefore, required and a complete conduit system in the "restricted area" and also for the main feeders. It was assumed that existing overhead equipment could be attached to by the city after proper rebuilding, at its expense, and upon payment of a yearly rental.

Every street was gone over and a record made of the overhead lines. A map was made for showing in detail the location as to side of street and ownership of all the underground conduits in Brooklyn. A large amount of data on the cost of conduit construction was obtained independently from two of the principal contractors in the United States, which checked very closely, and this was utilized as a basis for calculating the conduit plant. The record of existing underground was especially valuable in placing the proposed heavy runs so as to avoid existing systems.

The cost of reconstructing the pole lines was then worked out and the rental charge; also the expenses of building new lines where none existed. On the principal streets of Manhattan the present iron poles were duplicated. On the other streets of Manhattan and the other boroughs, poles of a somewhat different character were provided, equipped with mast arms, to bring the lights more out in the streets and away from the sidewalks. This is particularly desirable in the Bronx and places where the foliage interferes with the illumination from lights placed along the curb. Where lamps would be attached to pole lines a mast arm was used. Prices for this material were obtained from a number of manufacturers and the total cost calculated. The cost of making service connections from the streets to the centers of distribution and other buildings, both underground and overhead, was worked out, together with the cost of connecting the street lamps to the underground conduits and pole lines.

The next problem taken up was the calculation of the size of the load for which it would be requisite to provide equipment in the power house. In order to obtain the proportion of the maximum load to the total connected capacity, recording wattmeters were installed in a number of public buildings and calculations made from the bills for the entire lighting of the city, in every borough from which were derived the average number of hours burned by gas and electric lamps. The maximum equipment necessary in the main power house was thus derived and after a thorough comparison of the different types of power houses now in use, and the collection of a large amount of data as to the cost of machinery, the cost of a generating system was estimated.

To compare the cost of lighting in the various boroughs, under the municipal plant with the rates charged the city, the cost of lighting was estimated partly from meter readings, where bills had not been rendered, and partly from bills made out according to the rates charged up to December 31, 1904. An estimate was made of the cost of city lighting under the recent act of the Legislature. The exact number of lamps on a certain day was taken and a comparison between the above prices and unit prices made for each report of the commission.

Mr. Arthur Williams, of the New York Edison Company, discussed the paper from a number of points of view, and started with the observation that good service was of even greater vital interest than the cost. No street lighting was ever subjected to a severer test than that of New York on the day and night of the blizzard, occurring in the early part of this year. It will be remembered that such trains as succeeded in getting through (very few did) consumed from ten to fifteen hours between New York and Albany. The street car system was compelled to suspend operations, and cars were abandoned on every hand. Yet not a single street lamp failed to give the usual service. During the storm a prominent city official made a personal inspection of a great many streets and reported every lamp burning brilliantly.

Still another question may enter into the problem—assurances against interruption from transportation troubles, the weather or other causes. Would such assurances be of a more substantial nature were the city itself to manufacture the light it requires? The Engineering Commission failed to include anything like the coal storage capacity of the private companies. The New York Edison Company, in addition to carrying many thousands of tons in each of its generating stations—the bunkers of one station containing 15,000 tons—has provided a storage on the New Jersey shore of the North River of from 200,000 to 300,000 tons. From there coal can be taken in barges and delivered directly into the company's principal generating station. The supply is sufficient for two-thirds of a year, a period much beyond the possible duration of any interruption in the source of supply.

The commission was composed of engineers of the highest technical standing and one should, therefore, hesitate in criticising the plans adopted. Yet the system proposed was not equal to and does not give the assurances of the present system. It was understood that the proposed change would be made to secure a cheaper method

than that used by the private companies. For example, it would not be possible to use storage bateries, without the aid of which the best service cannot be maintained—and in fact without which no system supplied from a high-tension generating station can be operated without constant probability of interruption. It did not seem fair to compare a system, which at enormous cost has been developed to provide these advantages with one which to obtain cheapness omits them. The comparison is not "on all fours."

The cost of illuminating the streets is extremely low. For such illumination of an average unequalled in any other city, the per capita cost for each resident of Manhattan Island is less than $1 yearly. It is about two-tenths of a cent daily. A one-cent tallow candle burned nightly for each resident, would increase the present cost of municipal lighting fully five times.

Mr. Williams disagreed also with the views of the commission that the loss of taxes should be omitted from the operating cost of this plant. Almost without exception, curiously, taxes lost are omitted from all municipal ownership calculations. Advocates of municipal ownership, basing their premises largely, if not entirely, upon the expected, and in practice imaginary, profits to be derived from the enterprise, give little heed to the value of the taxes paid by private corporations.

The commission estimated that the mere operating costs of an arc lamp, including labor and fuel, are approximately $35 annually—not including interest or depreciation. For labor alone the cost of operating the municipal lighting plant which now supplies the old Brooklyn Bridge is in excess of $50 annually for each arc lamp supplied.

The commission stated that the nine small electrical plants now operated by the municipality in the Borough of Brooklyn cost annually $100,000. But the same, or better, service would be rendered to the city by the local electric light company at a cost not exceeding $70,000.

The largest municipal street lighting plant in the world is that of the city of Chicago. For a long time the city authorities have claimed that it is operated with great economy, and yet the report for 1904 states that the operating costs of an arc lamp were $54.36, or $20 more than the Engineering Commission allows for operating costs in this city. The Chicago figures do not include water, amounting to approximately $4 annually for each arc lamp. Furthermore, relative expenses are much greater in New York than in Chicago.

Another point at issue is the allowance for depreciation. This was originally placed at 7½ per cent by the distinguished chairman of the commission. But more recently the commission has reduced the figure to 6 per cent. Within twenty years the New York Edison Company has changed its generating system several times and another change is now in sight. The lowest expenditure estimate of the commission is now $7,567,000 and the annual difference between these percentages—6 per cent and 7.5 per cent—amounts to $113,505.

Mr. Williams then discussed the alternative plans of the commission, and showed that some of the plans admitted a heavy loss to the city if adopted. He contended that the loss thus bluntly admitted would indeed be much larger, because of the omission of sundry items. Such plans might, therefore, be dismissed from consideration. Special attention should be given, however, to the plan for an investment of $7,567,000 with an annual saving claimed of $434,000.

But the report did not include the cost of subways, which would be not less than $3,750,000; it does not provide for the equipment with wires and fixtures of the buildings now using gas; nor for the changing of the present electrical apparatus, including elevator and other motors. On a conservative basis this equipment would cost, including, properly, engineering expenses, not less than $2,750,000. Thus the ultimate investment by the city through the introduction of a municipal generating plant would be $14,067,000 to obtain a so-called "profit" of $434,000—about 3 per cent. But there would be no such differences as $434,000. The entire cost of lighting the city last year was $1,703,000. It was upon this basis that the hypothetical "profit" was obtained by the commission. The legislative reduction in the price of street arc lamps lessens this sum by $204,000; the reduction in incandescent lighting will lessen it from $15,000 to $20,000 more, and there has also been a reduction in the price of public gas lighting. But allowing only for the change in the cost of arc lighting the total margin claimed by the commission becomes reduced to $230,000, hardly more than 1½ per cent on the ultimate investment.

Moreover, there was no allowance for taxes lost, which amount to approximately $80,000 annually; no allowance for general expenses, executive and administrative, which for a plant of this size would amount annually to not less than $75,000; there were no changes incidental to the installation expenditure—$2,750,000—upon which must be allowed 10 per cent annually, or $275,000; likewise, all subway costs were omitted, which, on the basis of 10 per cent for interest, depreciation and taxes, would be $375,000; there was no allowance for the upkeep of the underground cable system, which would average not less than $2 annually an arc lamp or $30,000 altogether; the commission allowed the absurdly low figure of $8 annually for upkeep, maintenance, repairs and attendance for each arc lamp, yet no private company can render this service for as little as $12 annually. Adding the additional $4 they must again increase the expenses of operating the municipal plant by $60,000.

The aggregate of these additional items is $895,000, making an annual net loss to our taxpayers of $665,000, instead of a gain, as reported by the commission of $434,000. This loss would be made up by additional taxation.

Dr. Cary T. Hutchinson replied briefly to some of Mr. Williams' criticisms, disputing their accuracy. As to underground costs he repeated the claim of the city to enjoy free access to the ducts it needed.

First Ganz Three-Phase Railway in America.

The first electric railway to use three-phase, alternating currents on this continent will run between London and Port Stanley, Ontario, Canada, and it is expected to open one part of the line for service in about two months. This railway, besides being the first exponent here of the three-phase system, has another feature of special interest. The length of line now under construction is 27 miles, split into two sections of 18 miles and 9 miles, to be run with three-phase currents. Between these two sections there is a third one of about 2 miles, belonging to the St. Thomas City Railway, and run by direct current. The cars of the interurban road will run over the direct-current section, too, being furnished with a special equipment permitting this. The motor stator has a three-phase winding arranged in such a way that it may be fed with 1,000 volts alternating current or 500 volts direct current. The rotor has a commutator and four sliding contact rings, it being a two-phase armature when running with alternating current. Each car will have two of these motors, of an aggregate rated horse-power of 130. The series parallel control will be used for direct-current work, and the single-cascade control for alternating-current running. The trains to be hauled will weigh 35 tons and run at a maximum speed of 30 m.p.h. The line has several very heavy and long grades up to 5 per cent. The transmission and distribution e.m.f. is 10,000 volts, three-phase. This railway represents a novel application of the Ganz system, as it is a combination of alternating current and direct current that will enable the interurban road to enter the cities and its cars to pass over the street railway lines. It is expected that the railway company will soon extend its line east as far as Hamilton, a distance of 85 miles, using the same system. The Ganz system is exploited in Canada by Bruce Peebles & Co., Limited, of Edinburgh, and in the United States, Mexico, etc., by the Railway Electric Power Company, of New York.

The Chicago Electrical Show.

The management of the Chicago Electrical Show, which is to be held Jan. 15 to 27, announces that "College Row" is to be a feature of the exhibition. Three thousand square feet have been allotted to the schools and colleges of the middle west which have technical departments, where each school will display every day some novel tests and demonstrations. This department will be in charge of Dr. Henry Crew, professor of physics of the Northwestern University; Clarence E. Freeman, professor of electrical engineering at Armour Institute of Technology; Charles H. Smith, editor of School Science and Mathematics; Professor R. A. Milliken, of the University of Chicago, and Professor P. B. Woodworth, head of the technical department of Lewis Institute. The Northwestern Electrical Association and the National Electrical Salesmen's Association will hold conventions in Chicago during the time of the exhibition. January 17 being the two hundredth anniversary of the birth of Franklin, the directors are preparing a notable celebration programme for that day.

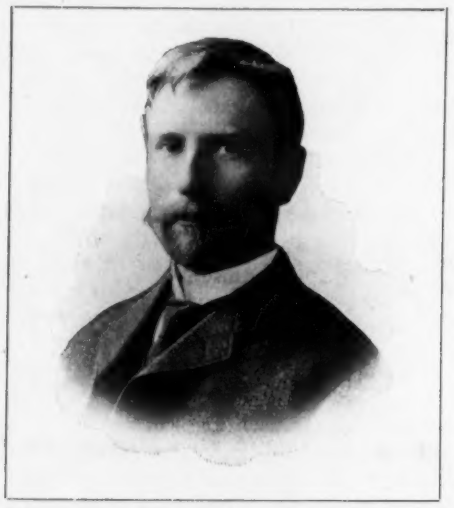
Electrical Engineers of the Times.—XXXIX.

MR. KEMPSTER B. MILLER.

Kempster Blanchard Miller was born in Boston, Mass., August 14, 1870, and received his preparatory education in the public schools and in the high school of Washington, D. C. He entered Cornell University in 1889, from which he was graduated with the degree of M.E., in 1893.

Immediately after graduation Mr. Miller entered the United States Patent Office, where he occupied the position of assistant examiner until 1896. Resigning from that service, he entered practical work in the field of telephony, becoming chief engineer of the Western Telephone Construction Company, Chicago, with which company he remained until 1898. During one year following he was connected with the International Correspondence Schools of Scranton, Pa., being text-book writer in telephony, telegraphy and other branches of electrical engineering. From 1899 to 1904 he was superintendent and engineer for the Kellogg Switchboard & Supply Company, Chicago. In May, 1904, he began professional engineering and expert work in partnership with Samuel G. McMeen, under the firm name of McMeen & Miller, in Chicago.

By far the most of Mr. Miller's adult activity has been in connection with telephone and similar intelligence transmission interests, and inventions resulting from his study of telephone problems have been a considerable portion of his contributions to that art. Most largely these relate to telephone equipment, particularly central office



KEMPSTER B. MILLER.

switching mechanisms. Of the inventions so made, more than 30 already have been subject of applications for patents in the United States and foreign countries. At intervals, however, he has made contribution by invention to other arts, an early example being an invention in the regulation of prime-movers, in which the basis is that of frequency, and the link between speed and power is electrical.

Mr. Miller's contribution to technical literature has been of a general character, and among the papers presented to engineering and scientific societies have been the following: "Irregularities in Alternating-Current Waves," prepared in collaboration with Frederick Bedell and G. F. Wagner, and presented before the American Association for the Advancement of Science, 1893. "Hedgehog Transformers and Condensers," prepared in collaboration with Frederick Bedell and G. F. Wagner, and presented before the American Institute of Electrical Engineers, 1893. "Practical Aspects of Electrical Resonance," presented before the Chicago Electrical Association, 1897. "Modern Telephone Engineering," presented before the New York Electrical Society, 1899.

Among readers Mr. Miller is best known by his work "American Telephone Practice," of which the first edition was issued in 1899, the second in the same year—the first speedily having been exhausted—the third in 1902, and the fourth in 1905. This book is quite generally referred to as a standard work on telephony, and has been continually revised and enlarged in the editions succeeding the first. The revision resulting in the current edition brings the volume to a size of about 900 pages, with over 600 illustrations, treating the history and present status of both science and art. The method of treatment chosen by the author is one effecting a compromise between the popular and didactic. Such a selection seems almost obligatory in handling one of the newer arts in a writing intended for general use by a public variously interested in scientific, industrial, historical and professional phases.

During the current year Mr. Miller has made a protracted and exhaustive examination of the fire alarm telegraph system of New York City, rendering a report in detail on its condition. Accompanying this report are his conclusions and recommendations as to the action necessary properly to protect the life and property interests of the Borough of Manhattan against fire damage.

Mr. Miller is a member of the Western Society of Engineers and of the American Institute of Electrical Engineers; of the Chicago branch of the latter body he is member of the executive committee for a fourth term, and chairman of that committee for a second term.

CURRENT NEWS AND NOTES.

MEDAL FOR AMERICAN.—The Royal Society of Arts has awarded a silver medal to the Hon. Robert P. Porter, former head of the U. S. Census Office, for his valuable paper read before the Society, season 1904-5 on "London Electric Railways."

NORTHWESTERN ELECTRICAL ASSOCIATION.—It has been decided to hold the Convention of the Northwestern Electrical Association at Chicago January 17 and 18, 1906, at the time of the Electrical Show, to be held at the Coliseum in that city.

NEW YORK ELECTRICAL SOCIETY has just issued its year book for 1905 containing the constitution and by-laws and the names and addresses of 638 members. The society maintains a steady rate of growth from year to year, and fills to perfection the place for which it was organized.

RAILWAY SIGNALS.—The Proceedings of the Railway Signal Association are to be issued December 12. They are full of interesting text and data pertaining to signals. The various committee reports and papers written during the year are reprinted, together with all the discussions on them, such topics being dealt with as lights, rubber covered wire, storage batteries, standard mechanical specifications, etc. Mr. H. S. Balliet, 335 Madison avenue, New York City, is the secretary-treasurer.

A. I. E. E. MEETING.—The two hundred and second meeting of the American Institute of Electrical Engineers will be held in the assembly room of the New York Edison Company, 44 West Twenty-seventh Street, New York, on Friday, December 15, at 8.15 p.m. The following papers will be presented and discussed: (1) "Some Considerations Governing the Location of Railway Sub-stations," by C. W. Ricker, electrical superintendent of power stations, Interborough Rapid Transit Company, of New York; (2) "The Relation of Railway Sub-station Design to Its Operation," by Sidney W. Ashe, associate professor of physics and electrical engineering, Brooklyn Polytechnic Institute, Brooklyn, N. Y.

GETTING BUSINESS AT DUBUQUE.—Mr. L. D. Mathes, general manager of the Union Electric Company, at Dubuque, Iowa, in response to a recent request from the editors for information on the business getting methods employed there recently, says: "We have not put out any original advertising matter during the past few months. The trade has been very kind in supplying us with artistic illustrated leaflets, which are of a higher character than we can ordinarily afford to turn out on our own account. Our business has not been standing still, however, as the connected load has enjoyed a very healthy growth. We find that actual results are obtained only by personal solicitation. We have two energetic young men to circulate round town and are constantly endeavoring to impress prospective customers with the superiority and desirability of the electric service. Undoubtedly a certain amount of advertising assists the solicitors, as it identifies our representative in advance of his call. Our experience has been, however, that good live men will go out and get more business in a week than will come as a result of the most ingenious advertising in a year. We have been quite successful of late with the new high-efficiency, high-candle-power lamps of the G. E. Company. We have about 75 of the large units out and they are now beginning to attract attention to the extent that people ask for them." It may be stated that Dubuque is a city of about 40,000 inhabitants.

BELGIAN TELEGRAPHS.—Government telegraphs and telephones in Belgium this year show better results, the receipts for the first four months of 1905 amounting to $749,129, against $692,649, an increase of $56,481.

WIRELESS 1,200 MILES OVERLAND.—The Atlantic De Forest Wireless Telegraph Company makes the announcement that on the night of November 30 its Manhattan Beach (Coney Island) station was in communication with the company's stations in Galveston, Tex., and New Orleans, La. The distance between the Manhattan Beach station and the others is over 1,200 miles.

NOT QUITE RIGHT.—The London *Electrical Times* remarks: "It is a popular superstition that Americans do everything electric quite right. Mr. Kempster B. Miller and Mr. J. J. Carty have just had to report on the fire alarm service in New York. The report is that it is fundamentally wrong in engineering design, and, moreover, in so bad a condition as to be liable to become wholly useless just when it is wanted. In fact, the only thing to be done with it would seem to be to tear it out and put in something fresh." There is no indication yet that this scathing report will be acted upon or any improvement made.

ELECTRICAL STIMULATION.—Prof. Frank W. Bancroft, of the department of physiology at the University of California, has completed some important experiments dealing with the effects of electrical currents on sea life, and has issued the results in a bulletin entitled "On the Validity of Pluger's Law for the Galvanotropic Reactions of Parameclum." Dr. Bancroft has succeeded in demonstrating that the cilia covering the body of the parameclum and the cause of its locomotion respond to electrical stimulation by changing the direction of their movement. When an electric current passing through water containing the paramensis is interrupted, the cilia reverse their beat on that end of the animal which is nearer the anode, or positive pole. When the current is made again, and during its flow, only cilia on the end nearer the cathode, or negative pole, reverse. These results are in strict accord with the law formulated by Pluger for the phenomena of muscular contraction under electrical stimulation.

VARIABLE-SPEED GENERATOR.—A patent issued November 28 to Moritz von Hoor, Friedrich Reinitz and Leopold Stark, of Austria-Hungary, relates to a variable-speed generator intended particularly for use with a storage battery in connection with the lighting of a train. The main generator is provided with two field coils. One of the coils is supplied with a current of constant strength from the storage battery, while the other is supplied with an opposing current, the strength of which varies directly with the speed. The source of this latter field current is a separate exciting dynamo, which is mounted on the same shaft with the main generator, its field coil receiving current directly from the storage battery. As showing the regulation obtained by this system it is stated that a certain equipment for railway train lighting supplied 5 kw at 33 volts at a speed of 50 miles per hour and furnished 800 watts at 31 volts when the speed decreased to 22.5 miles per hour, without necessitating any change or adjustment of the brushes or the rheostats in the field circuits.

THE SIMPLON TUNNEL.—We are advised from Europe that the Swiss Government has decided to open the operation of the Simplon tunnel with electric traction. The Simplon line is the longest railway tunnel existing, being about 20 km., and is the last link of an international railway line connecting Switzerland with Italy. The system to be applied is that of Ganz & Co., viz.: the high-tension, three-phase, which uses current at 15 cycles and 3,000 volts in the contact wires. The initiative to apply electric traction in the Simplon tunnel has been taken by the Italian Government, which for this purpose invited the Swiss Government to inspect the Valtellina line constructed by the Ganz firm. The Swiss Government commissioners have made careful studies of the installations of the Valtellina line with which they were so favorably impressed as now to decide on the application of that system to the Simplon line. The Swiss Government has also accepted the proposition of the Italian Government to place five Ganz electric locomotives used for the Valtellina line at their disposal for the operation in the Simplon tunnel. The line will be opened for public traffic on the first of May proximo.

GREAT TELEPHONIC EXPANSION.—The present enormous growth of telephony is emphasized by the raising of large sums of money for telephonic development. The stockholders of the American Telephone & Telegraph Company will meet on December 21 to authorize the issue from time to time of no less than $150,000,000 of convertible bonds. At the present time it has $131,551,400 of capital stock outstanding and paying dividends, and about $88,000,000 of bonds. According to the circular which has been sent to the stockholders, the bonds will be issued from time to time as business may require, with the right to convert them into stock after two and not more than twelve years at a price no less than par. The circular says that the company has sufficient cash in its treasury to meet all needs until well into 1906, but that the directors believe it advisable to have authority to issue bonds in order to act quickly in case favorable opportunities arise. Heretofore the capital required by the company has been provided either by the issue of stock or by the issue of its 4 per cent collateral trust bonds, payable in 1929, except that in the spring of 1904 there were issued debenture notes of the company to the amount of $20,000,000, payable May 1, 1907, and secured by 4 per cent bonds of the issue above described to the amount of $25,000,000.

TELEPHONIC COMPETITION.—Although the Atlantic Telephone Company holds that it is not required to meet all the conditions laid down by Harry P. Nichols, head of the Franchise Bureau of Comptroller Grout's office, and submitted to the Board of Estimate and Apportionment on October 12, officials of the company have submitted to Mayor McClellan a counter proposition, in which they express a willingness to pay the city $7,750,000 in cash for a franchise, and to provide the city with the use of 1,000 telephones for 25 years without charge. In his letter to the Mayor, Joshua D. Powers, president of the company, said the recommendations of Mr. Nichols, if adopted by the board, would make it impossible for the Atlantic or any other independent telephone company to undertake to do business in this city, principally because the present company has a monopoly of duct and conduit systems by which wires are carried underground. He objected also to a recommendation that the term of the new franchise be limited to 25 years, and that at the end of this term the city, if it desired, should take over the property for municipal operation. "It will be seen," Mr. Powers wrote, "that the Atlantic Telephone Company, which is to compete with the Bell Telephone Company at half its rates, is asked to give the city in 25 years $75,000,000, while the Bell Company pays nothing to the city except a franchise tax, which equally bears on the Atlantic Telephone Company."

THE PIONEER PERIOD.—In his paper on "Economic Waste and Competition," read recently before the Empire State Gas and Electric Association, Mr. W. S. Barstow said: "The industry of electricity supply might be stated to have its beginning on a commercial scale in the early '80's. Prior to that time the development of the science (as it was not a recognized industry) was more or less experimental and interesting only from this standpoint. The first electricity supply companies were, from a financial standpoint, decidedly speculative. Only those who could afford to part with their investment without inconvenience would consider lending their aid, and as often happens in the development of a branch of science into an industry, many of the early promoters and inventors fell in the struggle, their own enthusiasm causing their downfall. Since the early '80's the industry has passed through successive stages of construction and reconstruction, reaching not more than fifteen years ago a degree of permanency and beginning to attract the attention of the capitalist in general. Up to that time no more errors had been made in the development of the science than are made in the development of any art. All attention and efforts were devoted to the first principle of any industry—'to make it work'; this was the foundation of its existence. No one ever inquired into the expense 'of making it work,' not even the capitalist himself. It was recognized that a certain service was being performed and the charge was made accordingly. After this constructive period there came the necessary refinements; the capitalist having overcome the practical engineering difficulties began to realize that he never knew whether he was operating his business at a profit or a loss until sometime after either had actually taken place."

TELEPHONES IN A BARBER SHOP.—An enterprising barber in Paterson, N. J., has attached a telephone to each chair in his shop to enable customers to keep in touch with the telephone world while in the hands of the "tonsorial artist." In these days of strenuosity the telephone precedes a man wherever he may go.

CANADIAN TARIFF.—One of the requests made to the Canadian Tariff Commission is that of electric switch companies in the Dominion who desired "as they were subjected to severe competition from American manufacturers, that slate and fibre to be used in the manufacture of electrical goods, should be admitted free."

WIRELESS TO COLON.—Commander Beehler, commandant of the naval station at Key West, has reported to the Navy Department that the wireless telegraph station at Key West has received an eight-word message by De Forest wireless telegraphy from the station at Colon. The distance is about 1,000 nautical miles, and the Island of Cuba lies directly across the line between the two points.

BACK SEATS PREFERABLE.—It is stated that members of the congregation of the Munn Avenue Presbyterian Church, East Orange, N. J., occupying pews remote from the pulpit, now have neat little telephone receivers which are connected with a powerful transmitter located in the pulpit directly in line with the sound waves as they issue from the pastor's mouth. All that is necessary to do is to set a little switch lever when the occupant of the pew wants to hear the speaker in the pulpit more plainly, and the necessary connection is made. If the pew occupants do not wish to be disturbed they can stay cut out, but without attracting attention.

THE TROUBLES IN RUSSIA continue down to date, and have been intensified by the frequent interruption of telegraphic and telephonic service. This week the telegraph operators at Moscow have struck again and their strike may lead to a general strike in the postal and telegraph service throughout the empire and involve the railways and other trades and professions. The telegraphers' strike is due to the dismissal of men who, contrary to the orders of the government, formed a union of postal and telegraph employes. This week also the soldiers attached to the Military School of Electricity have been arrested by four battalions of the Pavlovsky Regiment and taken to the fortress of St. Peter and St. Paul.

A BADLY HUNG FIXTURE.—A cable dispatch from London of December 2 says: "The official visit of the Mayor of Grimsby to the George Street Wesleyan Chapel was characterized by a remarkable accident. The Rev. W. J. Boote, the Mayor's chaplain, was engaged in prayer when one of the electroliers stationed right above the pulpit fell from the roof. The electrolier first struck the choir rail, the shock causing the incandescent electric lamps to burst with a loud report which startled the whole congregation. Rebounding, the electrolier struck the clergyman, cutting deeply one of his hands which were extended in supplication. Several members of the congregation rose from their seats in alarm, but the courageous minister did not even pause in his prayer, but finished it with the blood dripping from his hand."

ENERGY AND MATTER.—In a recent address before the Twentieth Century Club, of Boston, Prof. Wilhelm Ostwald, of the University of Leipzig, said that phenomena like electricity and heat, while they cannot be elucidated by the notion of matter, can be explained or set in order through the idea of energy. In other words, the idea of energy is wider than the idea of matter. The greater part of physics and of chemistry can usually be taught without resort to the atomic hypothesis of the constitution of matter, and this is possible even in the elementary branches of the subject. The conception of the atom may be called symbolical, but it is not a useful conception. We can make our ideas in chemistry much clearer if we leave out the atomic hypothesis altogether. Prof. Ostwald said that in his work he always tries to handle and deal with measurable and tangible things without going beyond what can be shown measured or proven.

CANADIAN INTERURBAN ROADS.—United States Consul Culver, of London, Ont., thinks there is a good field in his district for the sale of material for electric tramways. He writes: "In this active, enterprising, thickly populated part of the Dominion, where factories flourish and where the best of local markets exist, there is an important feature of modern commercial and industrial life which is noticeably lacking, and that is interurban electric roads. The towns and cities are supplied with good electric lines, but there are few interurban lines in Ontario. In this consular district there is one completed road, some 12 miles in length, between the towns of Woodstock and Ingersoll, and a line some 30 miles in length under construction, running from this city to Port Stanley, on Lake Erie, but I know of no other lines in western Ontario, except the line from Windsor to Amherstburg; and yet the entire country in every direction is thickly populated and filled with thriving towns and villages. London is the industrial center, the market for all this territory, extending for some 60 to 100 miles in every direction."

RUSSIAN TELEGRAPH STRIKE.—A good opportunity is being afforded in the present paralysis in Russia due to the strike of operators, to witness the results obtained from government telegraphs. It would not appear that the telegraphers are at all happy, contented or prosperous under governmental régime, but go to extremities to secure even ordinary rights. Count Witte continues to refuse to deal with the telegraphers, declaring that for the government to yield would be equivalent to its abdication at their order. Nevertheless, the surrender of the government to their demand for the dismissal of M. Durnovo, acting Minister of the Interior, is regarded as inevitable. The striking telegraphers declare that they have ample funds and that they will not yield, even at the risk of dismissal. Telegraph officials on the railroads refuse to forward government or private dispatches, but are willing for the present to send and receive telegrams relating to the railroad service. Meantime, telegraphy within Russia has practically ceased, and owing to the cutting of the Danish cable it is difficult for people inside the empire to communicate with their friends outside.

EDUCATED ENGINEERS.—An article by Prof. V. Dwelshauvers-Dery, of Liege, Belgium, cited in the *Sibley Journal of Engineering*, quotes some interesting letters from its subject, the late Dr. R. H. Thurston, in regard to the growing appreciation of educated engineers. One of these dated in 1902 says: "Even the railway companies are asking me for engineers, whereas a short time ago it was very difficult to place a college man with them. . . . We are also entering shipbuilding, textile establishments, cement plants and all industries employing electricity. . . . The educated engineer, trained in the college, is now replacing everywhere the routine workman, the ignorant rule of thumb, and the man who called himself practical in the last generation. Our new generation of engineers adds to the ingenuity, to the spirit of enterprise and of energy, to the observation of the old-time workman, scientific skill and technical, theoretical knowledge, in such a way as to realize ideally the perfect engineer. Doubtless only a small number attain this degree of perfection, but the least successful is still worth far more than the best of the old type, and the most successful is incomparably superior. The proof is in the statistics of the situations held by our graduates."

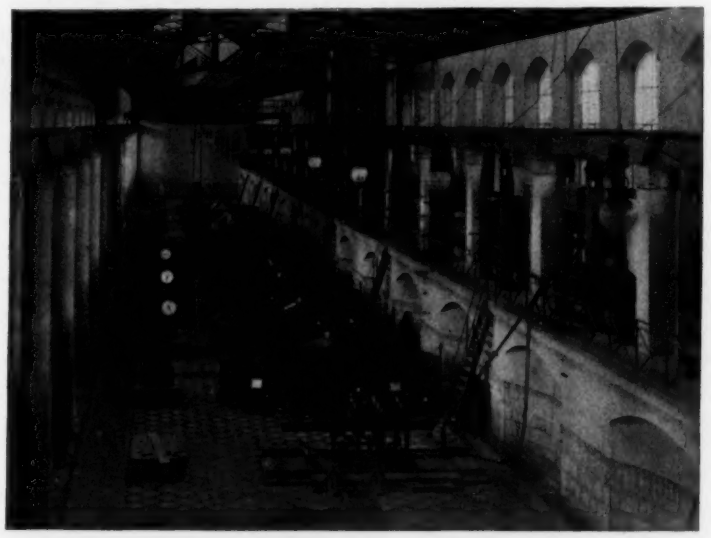
MOTORS FOR ARGENTINA.—Special Agent Hutchinson of the Bureau of Manufactures, U. S. Department of Commerce and Labor, in a letter from Buenos Ayres, discusses the use of small motors in the Argentine Republic, and says: "The motors wanted are of all kinds, from electric fan motors up to 4 or 5-hp gasoline engines for use on the estancias. In the towns there is steadily increasing use of electric power for small industries. Not only is Buenos Ayres well supplied with electric service, but many of the interior towns have their electric lighting plants, and wherever persistent efforts have been made to introduce small motors they have met with success. The Germans are particularly active in the matter and there are recent instances in which their goods have been pushed so energetically in new fields as almost to exclude the American. The moment a concession is made for the erection of an electric plant in a new place, German agents are to be found on the spot getting contracts for the installation of motors, thus gaining the advantage which comes from being first in possession of the field. There are openings at present at many interior points, notably Rosario, Santa Fe, Parana, Concordia and Corrientes. At the last-named town an electric plant is now in process of construction and will be completed in a few months. It is being built by a German company."

Hydraulic Station at Cusset, near Lyons, France.

BY F. M. BRYAN.

ONE of the largest hydraulic plants in France is the station which is controlled by the Société des Forces Motrices du Rhone. This station has been erected in order to utilize the power of the Rhone for operating lamps and motors in the city of Lyons. The fall which is employed for the turbines is obtained by the large canal which runs from Jonage to Cusset, and the station is located at the latter point. The volume of water which is obtained from the Rhone is some 100 cubic metres per second in times of low water and increases with the level of the stream so as to reach 150 cubic metres per second during the high water period.

The difference of level between the intake point and the outlet of the canal varies from 13.25 to 14.50 metres. During 300 days of the year it is in the neighborhood of 14.00 metres. The head of water at the station varies between 11 and 13 metres net, with a supply equal to 100 cubic metres of water per second. During the 60 days of high water in the Rhone, the fall may be below 11 metres, but the increased flow more than makes up for the difference in the fall. At all times the station disposes of a water supply which affords more than 14,500 hp.



FIGS. 1 AND 2.—VIEWS OF DYNAMO ROOM.

The load upon the machines in the station is quite variable during the different hours of the day. During the night at certain hours the load may be almost zero, and it may reach its maximum point in winter at 5 o'clock p. m. Taking into account the losses of all kinds, from the canal, the turbine and the machine, about 12,000 hp on the shaft of the turbines has been allowed for, and the plant has been laid out so that at certain hours of the day a maximum of 20,000 hp could be distributed.

The main station which contains the turbines and dynamos is built across the canal, and in addition to the repair shops and attendants' quarters, it contains a main dynamo room having a length of about 600 ft. and a width of 60 ft. Underneath the main floor are lodged the turbines, each in a separate chamber. Figs. 1 and 2 show the general appearance of the main dynamo room. It contains 19 machines, each driven by a separate turbine. Sixteen of the machines form the principal units, and produce three-phase current at high tension, while the three other machines serve as exciters. The latter are placed in the center of the dynamo room, and on either side are placed eight alternators.

Against the side wall and near the middle of the dynamo room is mounted the main switchboard containing the apparatus for handling the alternators and the exciters. A second switchboard plant in an elevated gallery in one end of the hall is used for the different feeders which start from the station. The mechanism for operating the turbine gates is placed on the opposite side of the room from the machine switchboard, and each set of apparatus is mounted near the turbine for which it is used. The water is brought to the turbines by horizontal conduits, and these are arranged so that each turbine can have the water supply cut off from the interior of the dynamo room without affecting the working of the others.

The principal turbines of the station, which, as already stated, are 16 in number, are of an improved type which is built by the well-known Swiss firm Escher, Wyss & Company. These wheels, each of which is direct coupled to one of the large alternators in the dynamo room, are of the reaction type and have vertical shafts. Of the total number of 16 main turbines which form the outfit of the station, 10 of the wheels are built to operate under the following conditions: The head of water in this case is from 10.1 to 12 metres. The water supply to the wheel varies in like manner between 12,500 and 10,500 litres per second. The normal speed of the turbines is 120 revolutions per minute. Under these conditions of working, each of the 10 turbines can develop 1,250 hp. In the case of the six turbines, whose construction presents some differences from the above and which are designed to give a somewhat higher power, the head of water varies between the limits of 8 and 10 metres, with a corresponding variation in flow of 15,000 to 17,200 litres per second. The average speed of the second class of turbines is about the same as in the preceding group, or 120 revolutions per minute, while the six turbines are capable of supplying from 1,350 to 1,500 hp in regular working.

The sectional view in Fig. 4 indicates very clearly the method which has been adopted in the Cusset plant for mounting the high-capacity and low-pressure turbines. The section has been taken in this case through the 1,500-hp turbine which has just been mentioned. These latter wheels are of the type which is known as the "Francis turbine," and this wheel has proved a favorite in the Swiss and in a large proportion of the French hydraulic plants of recent construction. The arrangement of the intake conduit, the position of the turbine in the special chamber which has been built for it, also the method of mounting the alternators on the top of the turbine shafts will be observed in the sectional view, as well as the position of the regulating mechanism of the turbine, which works upon a set of movable vanes within the wheel for controlling the water supply and thus keeping the speed constant. The control of the feed to the wheel can thus be carried out automatically by means of the governor, which causes an oil-pressure apparatus to act upon the vanes, or when desired the regulation can be carried out from a hand-wheel which is placed in the station near the machines. The oil-pressure apparatus, which has the form of a differential hydraulic piston with oil admitted to either side of it and moving it in, the forward or back direction, is operated from the shaft of the turbine in each case, and the shaft of the apparatus is connected by belt with the turbine shaft. Oil under pressure is supplied to the piston by a set of differential pumps. Part of the regulating apparatus is located in the main dynamo room of the building, and this part of the device, as also the pressure gauges, will be observed in Figs. 1 and 2, mounted beside each of the alternators.

In addition to the 16 large turbines which are used with the alternators, there are three turbines of smaller capacity, also furnished by Escher, Wyss & Company, which are used to operate

the exciter groups. The method of mounting the smaller wheels is practically the same as above shown, and they also have the inlet vanes controlled by an automatic speed governor. The three turbines for the exciters are all of the same pattern and have been designed according to the following data: For a head of water varying from 10.1 to 12 metres, the output is from 2,300 to 2,500 litres per second. The turbines operate at 250 revolutions per minute on the average. Each has a capacity of 250 hp.

During the preliminary work of the Cusset plant there were five different projects for the electrical equipment presented by a number of the leading European electrical firms. The system which was finally decided upon corresponded to the project which was furnished by the Swiss firm, the Société Anonyme Brown, Boveri & Cie., of Baden, using the three-phase system of distribution, with the high voltage for the line supplied directly from the alternators without the use of step-up transformers. All the electrical equipment of the station has, therefore, been furnished by the Brown-Boveri firm. It was at first desired to use a voltage of 5,500 on the

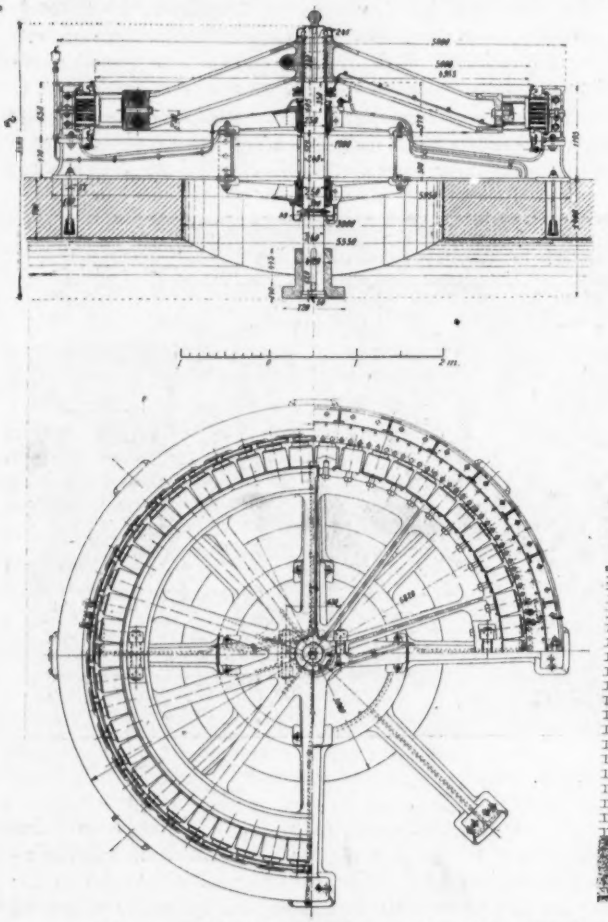


FIG. 3.—SECTION AND PLAN OF 1000-KW ALTERNATOR.

machines for supplying the feeder cables, but it was afterwards found necessary to adopt a reduced voltage of 3,500, due to the fact that the company which operates the Cusset-Lyons system wished to use a form of underground cable for the high-voltage feeders which had a paper insulation, and at the time of laying out the system the constructors of the cable could not give a guarantee for a higher voltage. A frequency of 50 cycles per second was decided upon, and it was found the most suitable for operating the motors on the line as well as for the arc and incandescent lamps.

The alternators are of the vertical-shaft pattern with an outer circular casting which contains the armature ring, and an inner revolving field, supported on the top of the turbine shaft by a series of radial arms. Space has been left in the station for adding other alternator groups as the demand for power increases. Each of the 16 three-phase alternators has a capacity of 900 to 1,000 kilowatts. Fig. 6, which was taken in the shops of the company at the time of building the alternators, shows the manner of constructing the revolving field. This form of field is the one which the company has recently brought out and which is preferred to the other types for the reason that the conical shape of the piece with the point of attachment placed high up on the shaft has the effect of lowering the center of gravity of the rotating part, and in practice this has been found a decided advantage in increasing the steadiness of running. This form is known as the "umbrella" pattern, from the shape of the upper part, which is formed of a set of arms connecting the main hub with the outer ring forming the field.

The section and the plan view of the alternator gives a very good idea of the method of construction. The revolving field structure of the machine consists of an outer ring of cast-iron which is used to support the pole-pieces. The profile of the ring is of a U form, and it is connected by the radial arms of double T section with a hub which fits upon the upper end of the turbine shaft. The field frame, as a whole, is formed of two halves which are bolted together, as is noticed in the plan view. The total diameter of the casting which forms the field ring is 4,400 millimetres. Around the periphery is mounted a series of 50 pole pieces which are formed of cylindrical cores of good magnetic steel having a diameter of 225 millimetres. On the end of the core is fixed a pole-piece of rectangular form, having the length about twice the width. The core and the polar projection form in this case a single piece, and the core is bolted on to the main ring from the inside. Each of the cores is provided with a field coil which is made up of 61 turns of insulated copper strip. The section of the strip is 3.5 by 20 millimetres, and it is insulated by paper, which is found to be quite sufficient in this case, because the difference of potential between the turns of the field is only 0.04 volt. The exciting current is brought to the field coils as usual by a two-ring collector which is mounted upon the shaft of the machine.

The outer casting of the alternator, which is stationary, is bolted down to the foundation and forms the support for the armature ring. The main circular casting of the armature, which lies on the upper part, is formed of two portions having a common diameter of 5.82 metres on the exterior. When bolted together, the ring which is formed by the two halves has a double U section. It is provided with a set of holes around the periphery which afford a good ventilation to the armature iron. The crown of the armature is bolted

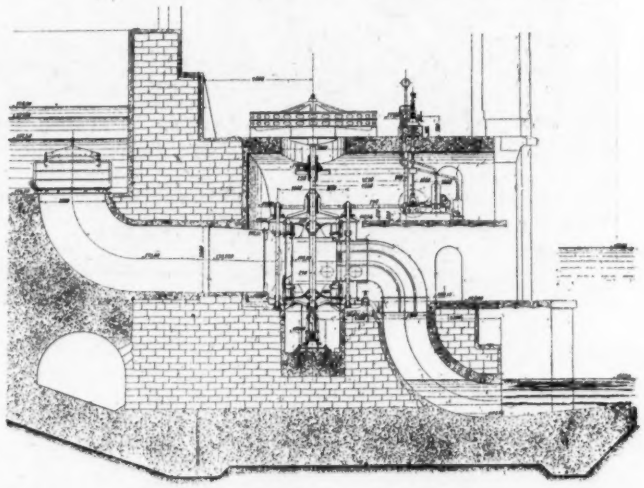


FIG. 4.—ARRANGEMENT OF 1500-HP FRANCIS TURBINE.

down to a series of foundation castings. The foundation plates are placed radially, and are joined near the center to a drum-shaped casting which forms a support for the two upper bearings of the turbine shaft. This construction will be seen in the section and the plan view. The two upper bearings are spaced 520 millimetres between their inner edges, and the top of the lower bearing of the pair lies about on a level with the flooring. It will be noticed that the use of the "umbrella" type of armature allows the upper bearings of the machine to be spaced wide apart, as is necessary in order to secure the best conditions of running, and at the same time the field ring of the alternator is sufficiently low to bring the center of gravity of the revolving part down to the proper point and thus give a great steadiness to this portion of the machine.

The working part of the fixed armature is formed of thin laminated iron which is insulated by sheets of paper. The laminated iron ring is strongly compressed between the two halves of the circular casting which serves to hold it in place. The armature winding is placed in a series of 150 holes of circular section, having a diameter of 50 millimetres. In each of the holes are placed 7 copper cables which are contained in an insulating tube of micanite. Each of the cables is made up of 37 wires of 1.5 millimetre gauge. The total section of the cable is, therefore, 65.5 square millimetres.

In each phase the conductors are joined in series and the circuits of the three phases are coupled in star connection.

When the station was first set running, the alternators were put through a trial test, in which it was found that the increase of tension which results in the passage from full load at the normal voltage to no-load (the value of the field and the speed of the machine remaining constant) has the following values: For $cos\ \phi = 1$, the rise of voltage equals 2.8 per cent. For $cos\ \phi = 0.74$, the rise is 13.7 per cent. As to the efficiencies, there were found to be the following: 94.6 per cent for a power factor equal to 1, and 93.3 per cent where the power factor equals 0.74. As to the exciters which are used in the station, each machine has its armature mounted upon the upper end of the turbine shaft in the same way as the alternators. Each exciter has a capacity

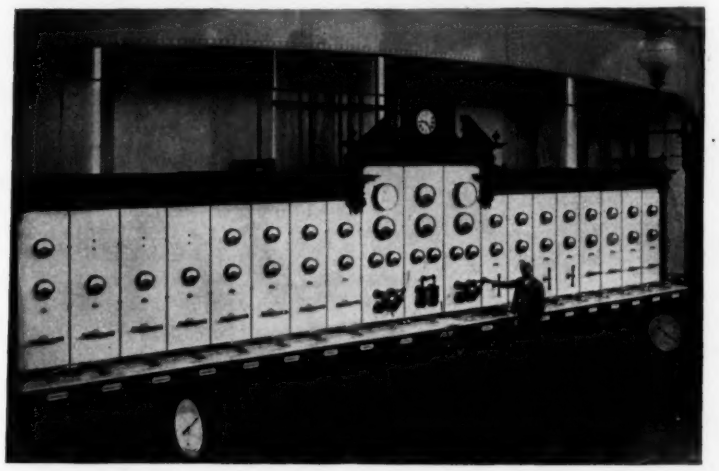


FIG. 5.—SWITCHBOARD.

of 1,500 amperes, and delivers a voltage of 120, and operates at a speed of 250 revolutions per minute. These machines are of the Brown-Boveri pattern, and are of the four-pole type. The exterior field frame is formed of a circular casting of soft steel. Each core has a circular section of 450 millimetres diameter, and on the outer end is fixed a pole-piece of elliptical section. The field winding which is placed on each pole consists of 693 turns of a 4.8 millimetre copper wire. To the upper part of the main casting are bolted a series of curved arms which join at the top and hold the upper bearing of the turbine shaft. In like manner the lower part of the casting supports the second bearing at the central part. The armature, which is mounted between the two bearings, is of the drum type. The core consists of a cylindrical ring having 900 millimetres diameter and 470 millimetres length of iron. It is formed as usual of laminated plates. The drum winding, which is placed upon it, consists of two parallel circuits. The wires are lodged in a series of slots upon the armature face, using one wire per slot and per circuit. An insulated copper strip of rectangular section, 4.5 by 1.6 millimetres, is used here. In the armature there is a total of 344 conductors, and the commutator has 172 segments. The latter has two pairs of copper brushes. Of these exciters there are three at present in the station; one of them acts as a reserve.

The current from the alternators is brought to the main switchboard by cables which are laid in conduits underneath the flooring. In the same conduits are placed the cables for the exciting current, above the main cables. A view of the principal switchboard of the station is shown in Fig. 5. The apparatus are disposed in three main parts. The central part is used for the totalizing instruments, and the apparatus and instruments for handling the exciters.

The three middle panels carry two wattmeters and a voltmeter for the main three-phase current, also an ammeter for each of the phases. At the lower part of the panels are an ammeter, a voltmeter and a double pole switch for each of the exciters. The current which is needed to excite the fields of the direct-current machines is taken from the bus-bars of the exciter circuit. The hand regulators for the exciter fields are placed under the projection in the lower part of the board which forms a casing to contain the mechanism.

The high tension, three-phase current from the machines is brought to three bus-bars which correspond to the three phases. These bars are divided into four sections, each of which can be separately connected to a system of bus-bars for the main current. Four of the alternators work upon each of the sections, and it is thus possible to carry out the cleaning or overhauling of any one of the sections, cutting it out of circuit without interfering with the working of the plant. Each alternator panel carries an ammeter, a voltmeter, a hand lever for operating the three-pole switch, which is placed behind the panel, and the phase-indicating lamps. The switch levers are placed so as to lie in the vertical position when the machine is connected in circuit, and this shows at once how many of the alternators are in operation.

The exciting current for the alternators, which is taken from the exciter bus-bars, is regulated by the rheostats placed in the circuit. The hand-wheels of the rheostats, like the set which has been already mentioned, project above the casing which contains the mechanism for operating the resistance coils. The whole set of rheostat boxes forms a continuous casing below the main panels, and a marble shelf covers it. The three middle hand-wheels are used for the exciter fields, and the remaining ones, which are of somewhat larger size, serve for the alternator fields. The hand-wheels are provided with stop-points and are connected together so as to allow of operating all the rheostats by means of a large central hand-wheel, which is placed in the middle part of the switchboard; at the same time the rheostats retain their individual operation. The resistance coils are placed at a point back of the switchboard and underneath the flooring of the gallery, which is formed of an iron grating.

The grating has been found necessary in order to secure a good ventilation of the resistance coils, which are further cooled by two air fans, each of which is run by a 10-hp motor. Both air fans and motors are likewise mounted underneath the flooring. To provide for the handling of the resistance coils, which have a considerable

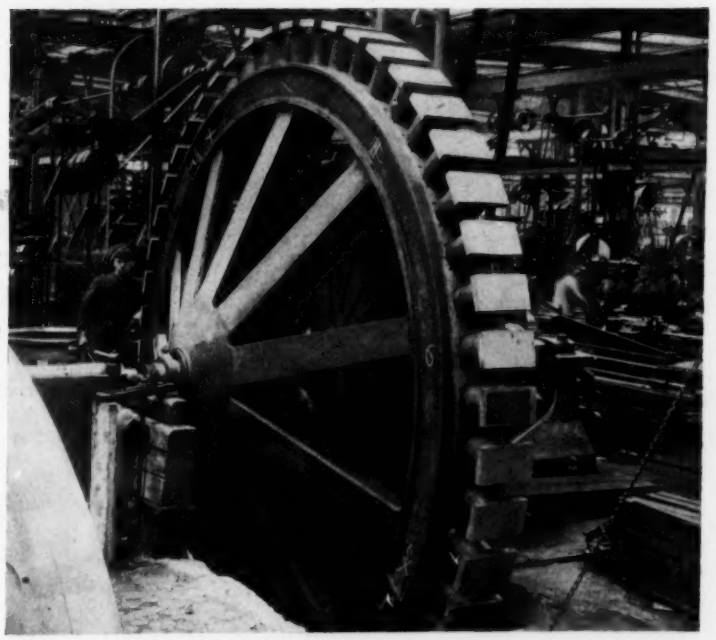


FIG. 6.—REVOLVING FIELD.

weight, a traveling crane is placed in the space back of the switchboard. The main switches are placed in small recesses of marble and are thus kept well separated from each other. Under the switches the transformers for the measuring instruments are lodged in somewhat the same way, and are closed over by wire gauze.

The main current passes through the totalizing apparatus mentioned above, and is then taken into the main bars which rise to an elevated point and pass along a gallery protected by wire gauze, reaching the feeder switchboard, which is a second board placed against the front wall of the building. The high-tension current is received in the feeder switchboard by a series of bars which supply the 12 feeders starting from the station. In each of the 12 feeder circuits are placed a three-pole high-tension switch, an ammeter and a set of fuse-blocks. In the center of the switchboard is located the ground-detector.

The hydraulic plant at Cusset has now been running for several years and supplies a large amount of power to the city of Lyons. The turbines and alternators have given good satisfaction ever since the station was started up. The present station is to be reckoned among the most important of the European hydraulic plants.

Belt Transmission of Power as an Analogue of Electric Transmission.

By Byron B. Brackett.

THE use of analogues to explain the various phenomena of current electricity is open to serious objection, yet the use of such analogues continues. Why these should be studied rather than the phenomena itself, is difficult to explain. It may be that certain minds can thereby remember two related facts more persistently than either one of them alone, and can likewise comprehend two similar reasons better than either of them without some mutual relation to the other. Or, it may be due to the inability of some persons to understand methods of explaining natural phenomena which go to the point direct, while indirect methods often lead those with this type of mind to the desired end. True it is that all analogues require comprehension of two subjects. Such devices cannot possibly reduce the amount of intellectual effort required to understand the phenomena which it is sought to explain by the analogy, unless the subject chosen to illustrate be thoroughly understood in advance.

Hydraulic analogies are often used to explain the phenomena of current electricity to students who themselves do not entirely comprehend the laws of hydraulics involved. This is well known. That the hydraulic phenomena usually employed, or the assumptions frequently made, illustrate only the more simple electrical phenomena and lead to absurd conclusions, if carried very far by way of analogy, is also beyond question. Such analogies continue to be used, in all probability, not because the student is thought to be familiar with the principles of hydraulics, nor yet because this class of phenomena is peculiarly suitable; but for the reason that the fiction of an electric fluid persists and permeates so thoroughly all of our electrical language.

The subtle, imaginary fluid, phlogiston, is no longer needed to explain our chemical theories. The fluid, caloric, has been abandoned in the treatment of heat phenomena; nevertheless, we still have our imaginary electric fluid to represent a condition or state of some portion of ether, probably as unlike the presence or flow of a fluid as anything could be. Why need we cling to such a fiction? If we admit its unreality, yet consider it merely a convenient assumption to bind together well-known facts, why illustrate it by hydraulic phenomena, actual or modified, and in a way that tends to make the assumption seem a reality?

If there is any necessity for illustrating, by phenomena connected with ordinary matter, the more general laws that govern the transmission of electric power, then the simple machine belt or rope drive will serve the purpose quite as well as water forced through a closed pipe system. No further modification or variation from the usual conditions of operation will be required, in the case of the belt drive, than it is necessary to make or assume in the common hydraulic analogy.

Imagine, for a moment, an endless belt passing as a wrapping connector in the regular way around two pulleys, or wheels, one driving, the other driven. The tension in this belt at any point may be assumed, for illustration, to represent an e.m.f. The velocity of the belt will then represent, by analogy, the phenomena of an electric current. The tension multiplied by the velocity of the belt gives, with due respect to the units of measurement, the energy transmitted in the unit of time represented by the speed, just as e.m.f. multiplied by current gives the electric energy, with similar respect to the units involved and the time considered.

To illustrate the effects of resistance and resistance losses in the electric circuit we must assume the somewhat unusual conditions of a driving belt operating in a perfectly viscous fluid, where the pull necessary to keep the belt moving through the fluid increases in direct proportion to the speed of the belt. This is not so exceptional a condition, nor so difficult to attain, experimentally, as the modification of actual resistance to the flow of liquids through pipes, which of course must be made in order to fit the hydraulic analogies to the phenomena they are supposed to illustrate.

The force required to pull the belt through such a viscous liquid as we have assumed would represent the portion of the tension lost, or rendered useless, before reaching the driven wheel. Hence, it represents quite satisfactorily the e.m.f. lost in the transmitting lines. This assumption makes the numerical value of the resistance to be the tension required simply to keep the belt moving at unit velocity. The actual properties of the electrical circuit will be illustrated by those of the medium surrounding the belt; but how these modify the resistance to motion need not now be considered. Given any resisting medium we may say by analogy that the belt tension divided by its velocity will equal the resistance. Change the resistance and the speed of the belt corresponding to any tension will change in an inverse relation; or, the tension required to produce a given speed will be modified, varying directly as the resistance of the medium in which the belt moves, all of which will be seen to be in accord with the relations of Ohm's law.

This law was stated by Ohm thus: "The strength of the current varies directly as the e.m.f., and inversely as the resistance of the circuit." But when applied to a portion of the whole circuit only, as, for example, to the transmitting line without including the motors, lamps or other receiving apparatus, the same relation may be more conveniently expressed, thus: the e.m.f. (needed for the portion of the circuit considered) varies directly as the product of the current and the resistance (of the part of the circuit under consideration).

It is further evident that the power consumed along the belt between the driving and driven wheels, would be proportional to the square of the velocity of the belt, illustrating, in this case, Joule's law.

According to this law, the heat developed in an electrical conductor, during any definite interval of time, is proportional to the square of the current and to the resistance of the conductor. Since the belt we are considering moves faster and pulls harder, at higher velocities, it illustrates most perfectly a conversion of another form of energy, into heat energy at a rate proportional to the square of the velocity of the belt, which is analogous to the electric current.

To grip this belt at any point of its motion and hold it in a position of rest would be similar to opening an electric circuit. The effect of the action, in either case, would be like inserting an infinite resistance at that point. When the belt is so held the driving wheel produces the full tension on the belt, at its point of application (or contact with the driving wheel), without causing any movement of the belt, just as the open-circuited dynamo develops an e.m.f. without delivering any current.

Starting and stopping conditions may now be considered. If the belt is without mass, or as is often said, without weight, its movements at once respond to the tensions produced at and by the driving wheel. The speed instantly reaches such a value that the resistance (the resisting forces) exactly equals the moving tension.

If the belt has any perceptible mass some of the moving or driving tension will be required to overcome the belt's inertia, as long as any change in speed is in evidence. Hence, a heavy belt would start slowly. It would keep or maintain itself in motion more persistently, so to say, when once set moving. This phenomenon represents the behavior of the so-called electric current in a circuit having self-induction. Since self-induction is a property not of the current but of the circuit, one might infer that it should not be represented by any analogous property of the belt, since that or its velocity has been assumed to represent the electric current. It may be recalled that such an inconsistency is committed by those who use hydraulic analogies; and, further, if one wishes, he may imagine the belt, which we are considering, to set into rotation any number of flywheels in the space about the belt by simply running over them. There may be many of them, and each one assumed to possess small inertia, to represent distributed self-induction; or, large and definitely located, to represent an inductance coil or some similar apparatus.

Moreover, if desired, one may find in the mass, radius of gyration, etc., of these inertia wheels, analogies for the magnetic flux, convolutions, etc., of an inductance coil. But it is not our purpose to examine these in detail. If there is mass inertia, directly connected with the changes in the speed of the belt in question, whether derived from the mass of the belt itself, or, from masses that are moved whenever the belt moves, there may be observed in either case phenomena analogous to those connected with a circuit having self-induction.

Should we attempt suddenly to stop such a belt as we have just considered, serious damage might result to the mechanism. The belt may break loose from the grip or other device which was introduced to stop it, and thence continue in motion for a time. This may ensue in spite of the efforts to check it, just as the electric current in a circuit with large self-inductance arcs across the switch, and maintains the so-called flow for an interval that is more or less brief, depending upon the circumstances. Again, the momentum

of the belt in such a condition might actually wreck some portion of the mechanism from the stresses caused by an attempt quickly to bring it to rest, just as an effort to stop, in too short a time, the electric current in a circuit with self-inductance may result in a puncture of the insulation of the conductor.

In fact, the actual equations that apply to the building up or dying down of the electric current in a circuit with self-induction, apply without change to starting or stopping a heavy belt. In which case, also, the mass or mass equivalent of the belt, and of all masses moved by it, take the place of the inductance of the electric circuit. The velocity of the belt is used for current strength, and the driving tension in the belt represents the applied e.m.f.

This may be proved as follows:

Let T = tension in the belt.
R = frictional resistance to movement of the belt, as previously explained.
S = velocity of the belt.
a = acceleration of the belt.
m = mass equivalent of the belt.
t = time from application of T.

Then, at any instant, we have

$$T - SR = am = \frac{dS}{dt} m.$$

or
$$dt = \frac{dS}{T - SR} m,$$

which may be written in the form

$$dt = -\frac{m}{R}\left(-\frac{R\,dS}{T - SR}\right)$$

Integrating between the limits $t = 0$ and t', and $S = 0$ and S', we have

$$t' = -\frac{m}{R}\left[\log\,(T - S'R) - \log\,T\right],$$

or
$$-\frac{Rt'}{m} = \log\left(\frac{T - S'R}{T}\right)$$

hence,
$$\epsilon^{-\frac{Rt'}{m}} = \frac{T - S'R}{T},$$

and finally
$$S' = \frac{T}{R} - \frac{T}{R}\epsilon^{-\frac{Rt'}{m}} = \frac{T}{R}\left(1 - \epsilon^{-\frac{Rt'}{m}}\right)$$

Thus, the velocity or speed of the belt, at any instant t' after a constant driving force, T, has been applied, is found by a formula which is identical with that for the electric current at a time t' after a constant e.m.f., E, has been impressed. The correspondence of the other quantities involved has already been noted.

The term $\epsilon^{-\frac{Rt'}{m}}$ in parenthesis in the above expression, becoming negligible when t' has a large value, the ultimate speed of the belt becomes constant at a value equal to T/R; and the time required for any fraction of this ultimate speed to be attained, will depend upon m/R, which is the *time constant* of the system.

By a like method, the stopping conditions, after the driving tension has been removed, may be shown to be given by the equation:

$$S' = \frac{T}{R}\epsilon^{-\frac{Rt'}{m}}$$

This may be considered in every sense analogous to the decay of the current value in an electric circuit with self-induction, after the impressed e.m.f. ceases to act.

We may now suppose the belt to be elastic so as to stretch when any tension is applied to it, till the elastic forces are sufficient to cause a steady movement of all parts of the belt; or, better still, we may imagine to exist between the surface of the belt and the medium or mechanism surrounding it, an elastic connection such that to establish any given speed of the belt a definite amount of stretching must occur, and remain operative so long as the same conditions of speed continue. In either case the initial speed of the belt at the driving wheel, resulting from the application of any constant driving tension, will be larger than would exist, if all other things were the same, and the belt with all of its connections had no elasticity. But, when the belt has been sufficiently stretched all phenomena will go on, while the driving tension remains constant, as if there were no elasticity to any part of the mechanism under consideration. When, however, the driving tension is removed, this elastic stretch will tend to move the belt backwards, for an instant. This is in all respects similar to starting an electric current in a circuit having capacity. For, when a constant e.m.f. is applied to such a circuit, there is a temporary rush of current into the circuit, larger than would flow over the same circuit if it had no capacity, or larger than the ultimate value of the current which is determined by Ohm's law. Again, when the e.m.f. is removed and the circuit kept closed there is a temporary back current which soon dies out.

To express the extra speed of the belt mathematically, we must consider a belt with unit elasticity to be one which will stretch a unit distance under a tension of unit value. Hence, one which stretches n units under unit tension will have an elasticity of n. Such a belt, if held firmly at the driven wheel, would move at the driving wheel, under the influence of a moving tension T, a distance, $D = Tn$, or $T = D/n$. These represent the ultimate conditions or those when rest ensues.

In general, after a definite interval of time, before the conditions of rest have been reached, a portion of the total tension (applied to the belt at the driving wheel) would be balanced by the elastic forces from the stretch already attained; and the remainder would be consumed in moving the belt against friction at the velocity then existing. Represent the tension required to balance the elastic force by T_1, corresponding to a stretch D_1. Then, $T_1 = D_1/n$. The other portion of the force will be equal to RS'.

Hence,
$$T = RS' + \frac{D_1}{n}$$

or
$$Tn = RnS' + D_1.$$

But
$$D_1 = \int S'\,dt,$$

or
$$Tn = RnS' + \int S'\,dt.$$

And differentiating, we obtain:

$$0 = Rn\,dS' + S'\,dt,$$

$$dt = -Rn\frac{dS'}{S'}.$$

Integrating this between the limits of 0 and t'; S_0 and S', we have

$$t = -Rn\left(\log\,S' - \log\,\frac{T}{R}\right)$$

since S_0 must be equal to T/R, all of T at that instant being available against frictional resistances. Solving the above for S' we now obtain

$$S' = \frac{T}{R}\epsilon^{-\frac{t}{Rn}}$$

This is entirely similar to the case of an electric circuit with a condenser inserted directly in series with it. The condenser puts in an infinite resistance at one point, but gives an effect of elasticity to the circuit.

We might consider the stopping conditions, and develop their formula when the belt is held, as above. Or we might develop the more important relations that apply when the belt is not held stationary at one point. This would be analogous to a closed electric circuit with capacity between different parts of the circuit. Here there is the current value which would exist without capacity, and, an additional current, at the start, obeying the laws above explained.

It is not necessary to multiply details. All of the interesting relations may be developed through using the analogy of the belt drive. Mechanical elasticity, in the sense that we have defined it above, is more nearly a perfect analogy of electric capacity than is shown in almost all illustrations used. It must be here remembered, however, as in the case of self-induction, that capacity is

distinctly a property of the circuit itself and not of the current. If any one should think that elasticity of the belt is not a proper analogy let him bear in mind that the elasticity may be applied to the regions near the belt and in contact with it, without making any changes in the relations which we have considered.

For the purpose of establishing a comparison with the possible operation of the belt transmission, the alternating current of electricity may, for the moment, be conceived of as starting and stopping continuously, first in one direction and then in the other. Now, if we rock the driving wheel back and forth, so to speak, the motion of the belt may be treated as an analogue of the alternating current. It is self-evident that any considerable inertia, or elasticity of the belt, would affect its motion, under such conditions, much more than when driven in one direction. Inertia and elasticity, as already defined, will modify the velocity of such a driving belt, moved first in one direction and then the other, in exactly the same way and to the same extent that self-induction and capacity are known to modify the alternating electric current. Moreover, formulæ showing these relations may be developed from the properties of the mechanism of the belt transmission; that is, the behavior or phenomena of the ether medium as affected by the transmission of an alternating current of electricity, may be illustrated by the well-known properties of ordinary matter.

Temperature Effects in Spans.

BY C. P. NACHOD.

THE purpose of this article is to show the relation between the sag and tension in a span of wire where there is a temperature variation. It is the result of some investigations for an overhead trolley construction where a knowledge of the variation of sag with the weather is necessary; and the conclusions have been substantially verified by measurements on an experimental span.

In order to simplify the calculations certain approximations have been made. For the flat curves in which wire usually hangs in practice these involve an entirely negligible error.

Ignoring at first any elongation of the wire under the stress produced by hanging, and supposing the temperature constant, all the desired relations can be expressed by two well-known equations, viz.:

$$l = y + \frac{8\,d^2}{3\,y} \tag{1}$$

$$p = \frac{w\,y^2}{8\,d} \tag{2}$$

The first is an approximate formula for the rectification of the parabola, a curve which, when flat, does not sensibly differ from the catenary, the true curve. The quantities involved are l, the length of wire in the span; y, the length of the span itself; d, the deflection of the middle point from the horizontal line through the supports, or sag, all being conveniently expressed in feet.

The second equation gives the relation between p, the tension in pounds; w, the weight of the wire in pounds per foot, and the span and sag. The tension, p, is that at the lowest point of the span. For any other point it is increased by the weight of a length of wire equal to the height of that point above the lowest—an ordinarily negligible increase.

If to the foregoing statements there is added that the wire elongates uniformly under heat at a rate dependent upon its coefficient of expansion, and that it elongates uniformly under tensile stress up to its elastic limit at a rate governed by the elastic modulus, E, all data are at hand for the investigation of the problem.

Assuming an unstretched wire of length l_c when cold and l_h when hot, α the linear coefficient of expansion of the material composing the wire, t the temperature range, the relations governing a temperature change may be expressed as

$$l_{ho} = l_{co}\ (1 + \alpha\, t). \tag{3}$$

If s is the unit fibre stress, β the reciprocal of the elastic modulus, l_o the length of the unstretched wire, l_s its length under the unit fibre stress, s, the analogous relations governing a change of stress are

$$l_s = l_o\ (1 + \beta\, s), \tag{4}$$

or more conveniently,

$$l_s = l_o \left(1 + \frac{p_s}{a\,E}\right) \tag{5}$$

where p_s is the total tension over the area a, the resisting section of the wire.

If the dimensions in the hot condition of the wire as stressed by hanging be denoted by subscripts $h\,s$, equation (1) being general, is true for any temperature, and may be written more particularly

$$l_{hs} = y + \frac{8\,d^2{}_{hs}}{3\,y}. \tag{6}$$

Also for the cold condition under the stress s' by subscripts $c\,s'$,

$$l_{cs'} = y + \frac{8 d^2{}_{cs'}}{3\,y}. \tag{7}$$

In a similar manner equation (2) for the hot stressed condition of the wire may be written as

$$p_{hs} = \frac{w\,y^2}{8\,d_{hs}}. \tag{8}$$

And for the cold condition under stress s' produced by it,

$$p_{cs'} = \frac{w\,y^2}{8 d_{cs'}}. \tag{9}$$

Proceeding thus for equation (5) there results

$$l_{hs} = l_{ho} \left(1 + \frac{p_{hs}}{a\,E}\right) \tag{10}$$

$$l_{cs'} = l_{co} \left(1 + \frac{p_{cs'}}{a\,E}\right) \tag{11}$$

where l_{ho} and l_{co} represent the lengths in the hot and cold unstressed conditions, respectively.

Eliminating l_{hs} between equations (10) and (6), and p_{hs} between equations (10) and (8) there results

$$d^3{}_{hs} + \frac{3}{8}\,y\,(y - l_{ho})\,d_{hs} = \frac{3\,w y^2}{64\,a\,E}\,l_{ho} \tag{12}$$

as the first important equation. To find the value of l_{ho}, this requires to be supplemented by another deduced by eliminating l_{co} between equations (3) and (11), and $l_{cs'}$ between equations (11) and (7), which gives

$$l_{ho} = \frac{\left(y + \frac{8\,d^2{}_{cs'}}{3\,y}\right)(1 + \alpha\, t)}{1 + \frac{p_{cs'}}{a\,E}}. \tag{13}$$

By multiplying out the numerator and omitting the product of the two right-hand terms as being negligible in comparison with y, a form is produced in which the numerator is calculable by the slide rule, viz.:

$$l_{ho} = \frac{y + y\,\alpha\, t + \frac{8\,d^2{}_{cs'}}{3\,y}}{1 + \frac{p_{cs'}}{a\,E}}. \tag{14}$$

In the case of a 300-ft. span consisting of a ⅝-in. steel messenger cable having a section of .2355 sq. in., and which, together with an inert load that it carries, weighs 1.43 pounds per foot, if a tension of 6,000 pounds is assumed for cold weather, the resulting sag may be found from equation (9):

$$6{,}000 = \frac{1.43 \times 300^2}{8 \times d_{cs'}},$$

which gives 2.68 ft.

To find the sag and corresponding tension in weather 100° F. warmer, it is necessary to find the length at that temperature and without stress from equation (14) as follows:

Assuming for steel $E = 30{,}000{,}000$ pounds per sq. in., $\alpha = .0000068$ for Fahrenheit scale,

$$lho = \frac{300 + 300 \times .0000068 \times 100 + \frac{8 \times \sqrt{2.68}^{2}}{3 \times 300}}{1 + \frac{6{,}000}{.2355 \times 30{,}000{,}000}} =$$

$$\frac{300 + .204 + .0638}{1.00085} = \frac{300.2678}{1.00085} = 300.01278 \text{ ft.}$$

The last operation cannot be performed on the slide rule since four or five significant figures are requisite.

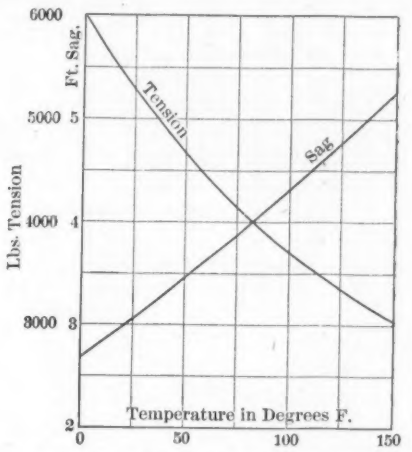


FIG. I.—CURVES FOR VARIATION OF TEMPERATURE.

This value is required for substitution in equation (12):

$$d^3hs + \frac{3}{8} \times 300\ (300 - 300.01278)\ dhs = \frac{3 \times 1.43 \times 300 \times \sqrt{300.01278}^{2}}{64 \times .2355 \times 30{,}000{,}000}$$

or $$d^3hs - 1.437\ dhs = 76.8.$$

Solving this by trial approximations on the slide rule gives the sag

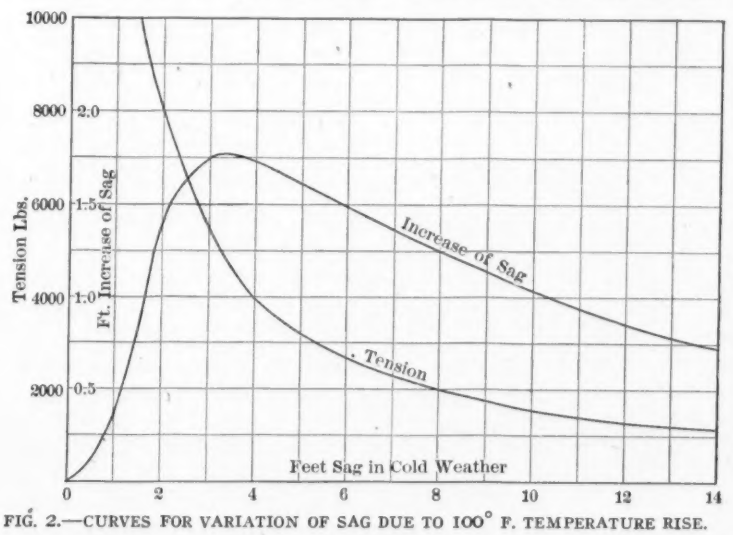


FIG. 2.—CURVES FOR VARIATION OF SAG DUE TO 100° F. TEMPERATURE RISE.

in hot weather as 4.36 ft., an increase of 1.68 ft., or 63 per cent over that in cold weather.

For the corresponding tension, substitute in equation (8):

$$phs' = \frac{\sqrt{1.43 \times 300}^{2}}{8 \times 4.36} = 3{,}690 \text{ lbs.,}$$

which is a decrease of 2,310 pounds, or about 39 per cent.

Fig. 1 shows in a graphical manner the variation of sag and corresponding tension with temperature for this span. Within the limits shown the sag increases almost directly with the rise in temperature. For an increase of 150° F. the tension is reduced to about one-half.

In Fig. 2, which applies to the same span, there is shown the effect of suspending the cable with various initial sags in cold weather and the resulting increase of sag for 100° warmer weather. The tension for each sag is also shown. It will be noted that there is a certain initial sag for which the increase in warm weather is a maximum. This is that value of the initial sag that will make the hot length without stress equal to the span, i. e., that value of dcs' that will make $(y - lho)$, the parenthesis in the coefficient of dhs in equation (12) equal to zero. In this case it is about 3.4 ft., for which the increase would be 1.77 ft.

This would be the condition to be avoided in practice, as it is usually not desirable that the sag should change much from winter to summer. There will be seen to be two initial sags giving the same increase in warm weather, the lower sags to the left of the maximum implying, however, abnormally high tensions.

In actual service a succession of spans would not be subject to as great changes in tension during the seasons as the curves show, since a very slight yielding of the support, as would happen, especially at curves, greatly diminishes the maximum tension in cold weather.

London's Power Supply.

BY T. H. MINSHALL.

AT present there are in London over 70 bodies engaged in the supply of electrical energy. In 1889 an attempt was made to concentrate production at Deptford, but this scheme, though sound in principle, was unsuccessful, because it was before its time. Since then the number of independent authorities has steadily increased, and it was with the object of putting a stop to further increase in the construction of comparatively small and costly stations, and gradually introduce a policy of concentration, so far as production goes, that the bill of the Administrative Power Company and a number of other schemes of a somewhat similar nature were brought before Parliament last year.

Of these the Administrative Power Company scheme was the one which attracted the most attention. This measure had two principal objects: First, the wholesale or bulk supply of electricity to railway companies and to existing lighting authorities for distribution by the latter; and, second, the retail supply of electricity to individuals for power purposes in certain cases, and under conditions, approved by the Board of Trade.

The bill was so framed that the existing authorities in each district had the first option of supplying the consumers themselves. If unable to supply from their own stations as cheaply as the power company, which would generally be the case, they had the option of purchasing power wholesale and retailing it themselves. Only in the event of their being unable to supply the consumer by either of these two means as cheaply as the company was prepared to do, was the latter allowed to give a retail supply for power. But the bill conferred no powers for competing with the ordinary lighting supply, which forms nine-tenths of the present authorities' business; neither did it in any way affect the control of the various undertakings. The object of the company was, and is, to produce current on a larger scale, and hence at a lower cost than is possible in the present stations, and to sell energy wholesale to the existing authorities for them to retail. As was said at the time, the only change which this need involve would be that the existing authorities would purchase *energy* in place of *fuel*, and cease to enlarge their existing stations.

The following table, which was given in evidence, shows the relative cost of production in the existing stations of the borough councils, and the prices at which they could demand an equivalent supply from the power company; i. e., at the maximum prices the power company is authorized to charge:

	Total cost of production, 1904.	Cost of bulk supply delivered.
Battersea	$54,225	$38,860
Bermondsey	20,890	12,580
Fulham	49,580	35,890
Hackney	71,155	56,270
Hammersmith	91,060	59,645
Hampstead	155,730	99,350
Islington	145,900	83,485
Poplar	56,020	50,350
Shoreditch	140,500	77,520
Southwark	40,090	20,310
Stepney	63,180	54,340
St. Pancras	175,905	122,085
Total	$1,064,725	$710,685

The right to distribute the energy so purchased for light or power will be left in their hands, if they choose to exercise it, but

if not, the Board of Trade is empowered to allow the consumer to obtain a supply direct from the power company. It is, obviously, a matter of indifference to the generating company whether it deals with the distributing company or with the individual user direct, provided always that there is some guarantee that the consumer obtains the full benefit resulting from cheap production; for without this the demand for electricity will not grow at a sufficient rate to make this scheme commercially feasible.

The bill was heard at great length by committees of both Houses and passed, together with the bills of the Metropolitan and North Metropolitan Power Co., thereby dividing London among three power companies. This has been somewhat overlooked, the belief having been general that one company covered the whole area. As the scope of the scheme became better understood, the opposition of the existing companies, and of a number of local authorities was withdrawn, and many agreements for bulk supply come to, but a number of boroughs, including Poplar, West Ham, Woolwich, etc., together with the London County Council, maintained their opposition to the end, with the result of delaying the proceedings to such an extent that there was no time for the bill to go to third reading. It has thus to be brought forward again, but it is not expected that it will involve such a lengthy struggle as it did last year now that the majority of the points have been threshed out and the modifications suggested by Parliament inserted.

The opponents, of whom the principal was the London County Council, maintained that the existing authorities were in a position to supply all London's power requirements, and that, in any case, to compete with them would endanger the security upon which the Council has advanced large sums of money for electrical purposes to the borough councils. At a later stage of the Proceedings the Council agreed that concentration was desirable, but that the Council itself was the proper body for providing such a supply to the existing authorities, for which purpose, in fact, it had already, unsuccessfully, promoted two bills before Parliament.

The following table gives some particulars of the systems in the original area proposed by the bill, from which Hertfordshire and half of Middlesex was excluded:

Total number of stations	62
Average size of stations in kilowatts	2,920
Total number of engines	537
Average size of engines in kilowatts	338
Number of different voltages	25,
Number of different systems of generation	35
Number of different systems of supply	27
Number of different voltages of supply	24

There are thus no less than 62 stations of an average size of only 3,000 kilowatts, or less than one-fifth of the size of the individual turbines which the power company proposed to use. This, of course, excludes the innumerable private installations in large works, some of which contain several thousand horse power. The variety of systems at present in vogue not only prevents amalgamation, but also necessitates manufacturers of electric motors carrying a very much larger stock of motors than would be required in the case of a uniform system.

The following table gives particulars of the capital outlay, etc., in the Metropolitan stations:

Total capital expenditure	$82,993,575
Kilowatts of plant installed in lighting stations	181,034
Capital expended on stations	$46,219,910
Capital expended per kilowatt installed	$255
Kw-hours units generated	159,154,144
Plant costs	$3,651,660
Plant costs per kw-hour generated	2.2 cts.
Capital charges on stations	$2,728,335
Capital charges on stations per unit generated	1.64 cts.
Total generating costs	$6,379,995
Total generating costs per kw-hour generated	3.84 cts.
Gross revenue	$11,725,145
Gross revenue per kw-hour generated	7.08 cts.

In view of these figures it is not surprising that London is very much behind other cities in its consumption of electric power, and the following table gives particulars of this:

Name of city.	Population.	Horse-power connected per 1,000 head of population. All purposes.	Power only.
Boston	600,929	164.6	41.3
Tyneside	222,241	122.8	30
Frankfurt	306,000	80.1	28.7
Berlin	2,285,000	82.1	22.0
New York	3,732,903	52.6	13.9
Hamburg	700,000	76.7	12.7
Glasgow	786,897	43.9	8.26
London	6,565,390	48.0	5.4
London ("industrial area")	3,812,283	25.8	4.8

It will be seen that London as a whole uses more power per head than the industrial area, due to the fact that in some of the western districts, such as the Strand, etc., space is so valuable that electric power has to be used by the printers, etc., at any cost.

The fact was very clearly brought out before the committee by various manufacturers that, hitherto, the purchase and general use of electric power in ordinary works was—except in special cases, where space, etc., made it necessary—the exception rather than the rule, and this is shown by the following table, from which it will be seen that only about 4 per cent of the power used in the factories of the industrial area was electric power supplied by the present plants:

	"Industrial" area.	Proposed area of supply.
Total number of hands employed:		
1898	458,856	609,894
1911	534,458	706,227
Total horse-power installed of all kinds in factories, etc.		
1904	456,415	592,992
1911	484,148	636,695
Horse-power of motors supplied by present lighting authorities:		
1904	18,316	34,236

Both opponents and promoters were quite in agreement as to the advantages possessed by electric power over other forms; where they differed was as to the best means of bringing about its general adoption. During the first part of the proceedings the companies' and the existing local authorities' contention was that the present methods, if allowed to develop, would, in time, suffice to meet the needs of the metropolis, and to provide a supply of power at such rates as would insure its general adoption.

The promoters, however, contended that the present methods were radically wrong, and that the longer they went on the worse it would become, and that the only correct way to deal with the problem was at once to inaugurate a policy of concentration in place of the continual addition to the number of stations supplying London.

To show the economy of concentration the following table was prepared, in which the figures of the Administrative Company's stations in London, as furnished by their owners, are contrasted:

Causes to which Economy is Attributed.	Adm. Co. 90,000 kilowatts.	Existing stations. 3,000-kw. average size.
Reduced capital outlay, due to— (a) Lower cost of large turbines; (b) Lower cost of iron buildings; (c) Lower cost of sites	$42 per kw.	$252.50 per kw.
Reduced coal costs, due to— (a) Greater efficiency of large machines; (b) Better sites for coal delivery and condensing water	.304 cent per kw-hour.	1.26 cents per kw-hour.
Reduced cost of operation, labor charges, etc., due to— (a) Use of turbines; (b) Use of larger units of plant; (c) Use of coal handling and other automatic appliances	.106 cent per kw-hour.	1.08 cents per kw-hour.
Reduced capital charges per unit, due to— The greater number and variety of demands for power in a large area supplied by one station, enabling the machinery to be employed for a longer period each day and hence yielding a greater output with the same capital thereby reducing the capital charge per unit of output.	.218 cent per kw-hour.	2.58 cents per kw-hour.

The Administrative Company proposed three stations, one at Greenwich, one at West Ham, and a peak station at Fulham, though they did not undertake to construct this at first. The extraordinary reduction in the cost of large stations is clearly shown by the above table, and that these figures were by no means fanciful was shown by the fact that tenders had been received to supply all the apparatus for the figures therein mentioned, while the cost of the station already built on Tyneside was only some $10 per kilowatt higher.

Apart from the advantages of uniformity and of economy, it would, obviously, be an advantage to London if it were possible to remove the various generating stations from out of the congested central area. This cannot be done under the present conditions. The Administrative Company proposed a solution of the difficulty; the existing companies at first proposed alternatives, while the County Council proposed further delay.

After an extremely lengthy hearing the committees of both Houses decided that the best method of solving the problem was to create a new company for the purpose of supplying power, in order to insure the principle of competition being maintained, which would have been difficult had the existing authorities been endowed with these powers. But the interests of the existing authorities were very carefully safeguarded against injury by clauses specially framed for this purpose by the House of Lords. It is understood that next session the promoters will ask Parliament to confirm this decision.

Reflectors, Shades and Globes.—III.

BY J. R. CRAVATH AND V. R. LANSINGH.

THE two previous articles on this subject dealt mainly with the older and more familiar types of reflectors and globes. This and the following articles will take up mainly some of the newer and special types, patented and unpatented, which have been coming into prominence in the past few years.

Fig. 14 shows the distribution about a 16-cp lamp equipped

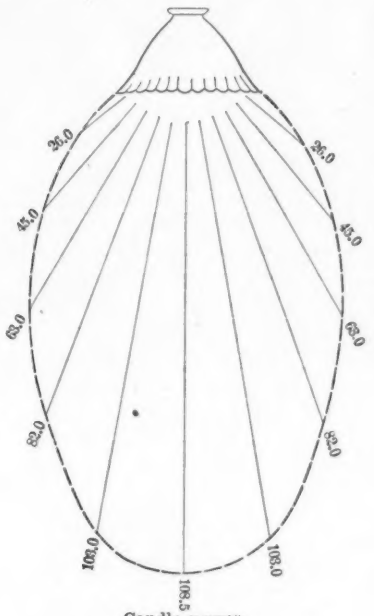
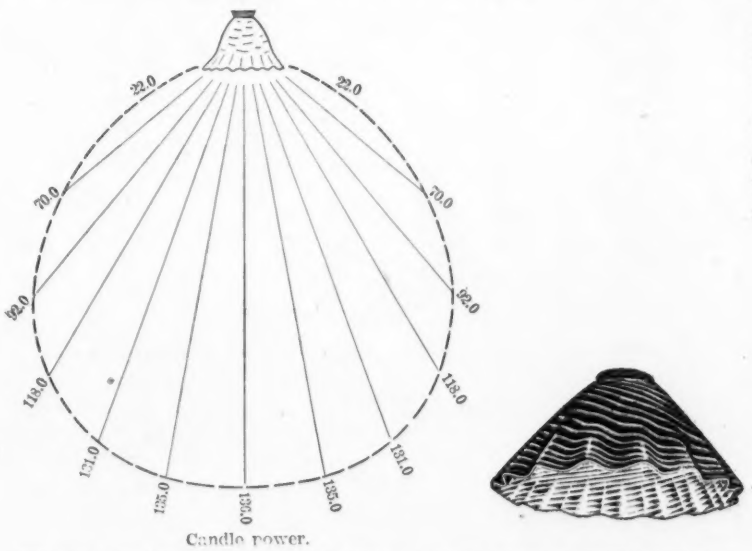


FIG. 14.—DISTRIBUTION OF LIGHT FROM X-RAY DESK SHADE.

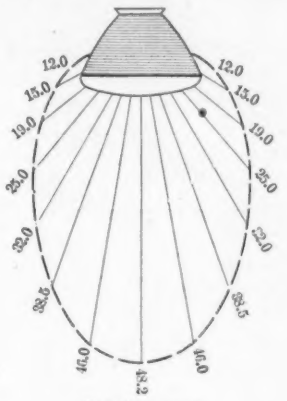
with what is known to the trade as a 10-in. X-ray desk shade. This shade is shown in Fig. 15A. The light distribution from a 32-cp lamp with the same reflector is shown in Fig. 15. This is a shade



FIGS. 15 AND 15A.—DISTRIBUTION FROM 32-CP LAMP WITH X-RAY SHADE.

with a corrugated mirror reflecting surface, the reflecting surface being applied under the paint which covers the outer surface. As seen by Fig. 14, this reflector has a tremendous concentrating power, giving over 108 cp at the tip of the 16-cp lamp. With a 32-cp lamp, the maximum candle power covers a much larger angle than with the 16-cp. Streaks of light which are likely to be present with mirror reflectors are in this case partially wiped out by the corrugations, so that, except when the work is very near to the lamp, this reflector can be used without a frosted bulb lamp, although the latter is recommended. This reflector is an excellent one to use wherever good, powerful, concentrated light is desired and where an opaque reflector is not objectionable. It is well suited to show-window lighting, office desk lighting and billiard table lighting wherever other lights are present for the general illumination of a room. It is considerably more expensive, heavier and more likely to be injured than the frosted aluminum cone, Fig. 8, but it gives a much more powerful light and is more easily kept clean on account of its smooth inner surface.

Fig. 16 shows the light distribution about a 7-in. McCreary desk shade, shown in Fig. 16A. This is a shade which has a silvered

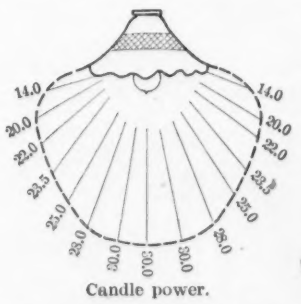


FIGS. 16 AND 16A.—DISTRIBUTION OF LIGHT ABOUT A M'CREARY SHADE.

mirror reflecting surface, but instead of being open, as are most reflectors, it has a ground-glass bottom through which the lignt must pass and which eliminates the streaks. It is, of course, intended to give a concentrated light for desk use and draughting. The maximum candle-power below the lamp is about 48. Its performance on the whole is very similar to that of the frosted aluminum cone, but this type of reflector has the advantage that no matter what angle it may be placed at, the bare lamp is not visible, as all the light comes through ground glass. For desk work, where it is almost always desirable to place the reflector at an angle, this is a good feature. This shade should never be used without a mica or asbestos gasket in the shade holder to prevent dirt collecting inside of the shade.

The "McFadden" shade is similar to the "McCreary," except that its reflecting surface is opal with green backing like the common desk shade. It is, in fact, the common desk shade with a ground glass bottom. It is not subject to deterioration of the reflecting surface like the "McCreary" and "X-Ray," which depend on mirrors for their reflecting value.

Fig. 17 shows the distribution of light about a 6-in. ornamental X-Ray reflector, illustrated in Fig. 17A. This gives a candle-power of from 20 to 30 at the most useful angles below the horizontal. The principal application of this reflector is in connection with clusters and on ceilings, where the fact that the reflector is opaque

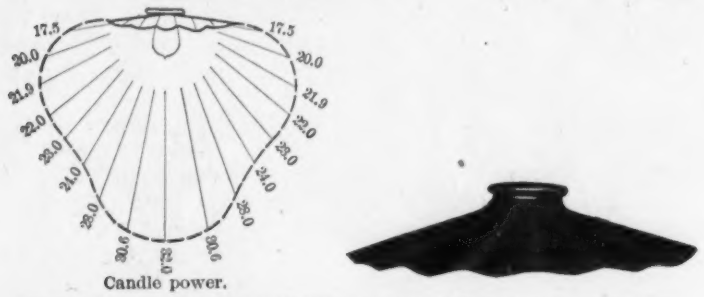


FIGS. 17 AND 17A.—DISTRIBUTION FROM X-RAY REFLECTOR.

is not a drawback. It is sometimes used by mistake where the more concentrating type of X-Ray reflector shown in Fig. 15A should be used. The use of this or any other reflector on a chandelier or cluster at an angle and hung low enough to be in the ordinary line of vision is objectionable on account of the glare received in the eyes. The remedy is the use of frosted bulbs or the placing of the cluster high.

Fig. 18 shows the distribution of light about a 16-cp incandescent lamp in a 10-in. flat fluted X-Ray reflector. Although a reflector of this form would naturally be expected to give a rather wide distribution of light below the horizontal, it will be seen that the candle power directly below the lamp is considerably higher than with other flat reflectors shown in this series of tests, while the candle power a little below the horizontal is nearly as great as with some of the other flat reflectors. The shape of this

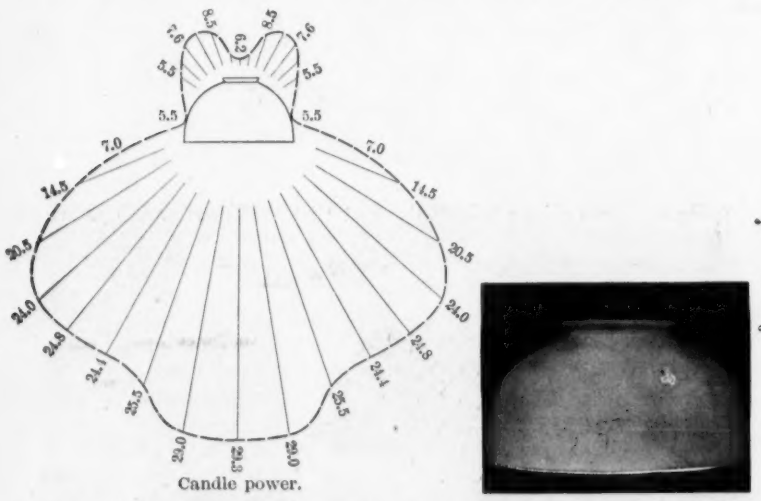
reflector is shown in Fig. 18A. The proper place to use a reflector of this kind would be where it was desired to illuminate a considerable area and at the same time to obtain much light immediately



FIGS. 18 AND 18A.—DISTRIBUTION FROM FLUTED X-RAY REFLECTOR.

under the reflector. Like all opaque reflectors it cannot be used where darkening of the ceiling is objectionable.

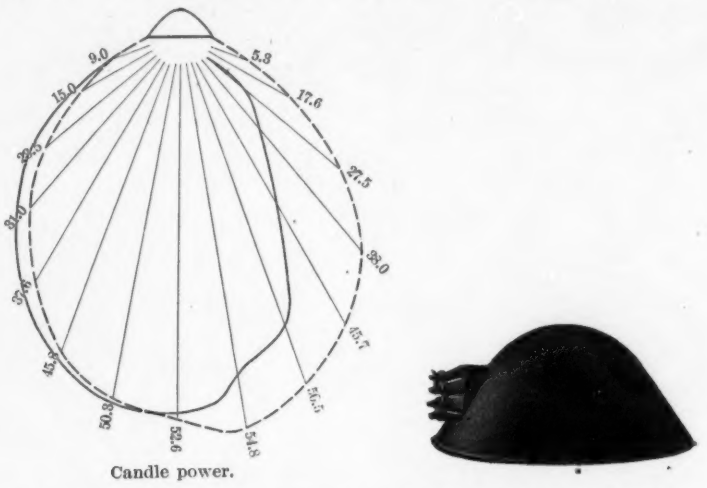
Fig. 19 shows the distribution of light about a 16-cp power incandescent lamp in a white opal dome reflector, the form of which is shown in Fig. 19A. This is an excellent reflector for many common uses. Being 3¼ in. deep, and 7 in. in diameter, it covers the lamp so as to act as a diffusing globe to a certain extent, while at the same time it gives an excellent distribution of light in all downward directions, the maximum being somewhat over 29 cp. It is a good type of reflector to place pointing straight downward over the center of a dining-room table, one lamp giving illumination over the entire top of a fairly large table. It can also be used on chandeliers for the general lighting of all classes of rooms. When so used it should be pointed straight down, because if placed at an angle it will give more light than is necessary on the high side walls. It is interesting to compare this with the opal reflectors, Figs. 3 and 4. The maximum candle-power of this opal dome reflector is considerably greater than from the fluted opal cone, shown in Fig. 3. This candle power extends about 10 degrees each side of the vertical, and the balance of the distribution is very similar to that of the fluted opal cone. This would be a good reflector for reading and desk use, but for the fact that



FIGS. 19 AND 19A.—DISTRIBUTION FROM WHITE OPAL DOME REFLECTOR.

having a smooth reflecting surface, the light is somewhat streaked. The streaks can be overcome by the use of a frosted bulb lamp, as in other types of smooth reflectors. Although not specially ornamental in its usual form, as found on the market, it could easily be made so. It is another good example illustrating how little attention is commonly paid to combining the useful and the artistic in glassware and how much room there is for improvement and development along this line.

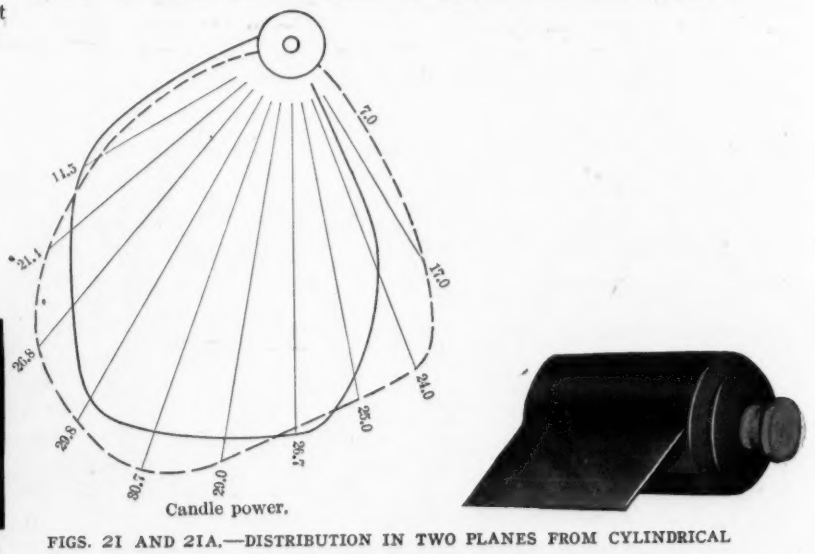
Fig. 20 shows the distribution of light in two planes about a 16-cp incandescent lamp in a parabolic aluminum reflector with frosted aluminum finish inside. This reflector is shown in Fig. 20A. The candle-power in the vertical plane of the lamp axis is shown by dotted lines, as in the other diagrams, while the candle power in a vertical plane at right angles to the lamp axis, technically known as normal to the lamp axis, is indicated by a heavy line on the same diagram. This is a reflector which is coming into common use for desk and office work, as well as for shops and all places where a light, easily adjusted, opaque reflector is needed. This test shows the reflector to be an excellent one for this purpose. It gives over 50 cp at the angles where the light is most wanted in desk lighting, and gives over 40 cp through an angle



FIGS. 20 AND 20A.—DISTRIBUTION IN TWO PLANES FROM PARABOLIC ALUMINUM REFLECTOR.

of about 70 degrees. The reflector is light and is usually made so that it can be quickly turned at any desired angle. The easy way in which it can be adjusted, as well as the excellent distribution of light from this reflector, are strong points in its favor. Reflectors of this kind can be obtained with various outside finishes so that they will harmonize with almost any surroundings. Not being patented articles, they are low in price. For use in dirty machine shops, it may be advisable to purchase them with smooth polished finish instead of the frosted finish inside. For most cases, the streaked light from the polished aluminum will be objectionable. Generally, the frosted aluminum finish is the one to be chosen.

Fig. 21 shows the distribution of light in two planes about a



FIGS. 21 AND 21A.—DISTRIBUTION IN TWO PLANES FROM CYLINDRICAL DESK REFLECTOR.

16-cp incandescent lamp placed in a cylindrical desk reflector with aluminum paint finish inside. This reflector is shown in Fig. 21A. The solid line shows the light given in the plane of the lamp axis, while the dotted line shows the light given in the plane at right angles or normal to the lamp axis. Cylindrical desk shades of this kind are in common use, and may be compared with the parabolic shade shown in Figs. 20 and 20A. The light obtained from the cylindrical desk shade is considerably less than from the parabolic reflector. Not only is the maximum candle power approximately half that of the parabolic shade, but it does not extend over as great an angle. The cylindrical form of shade with aluminum paint finish is, however, much to be preferred to the same shade with white paint finish, as the latter causes streaks in the light which are extremely objectionable and necessitate the use of frosted lamps.

Fig. 22 shows the distribution of light about a trough reflector, in which the reflecting surfaces are glass mirrors. Such trough

reflectors are made for store window lighting purposes, being placed at the top of the window out of sight from the street. This reflector is shown in Fig. 22A. Fig. 22 shows the light on vertical plane normal or at right angles to the reflector. This can be compared with the light thrown from the X-Ray reflector, shown in Figs.

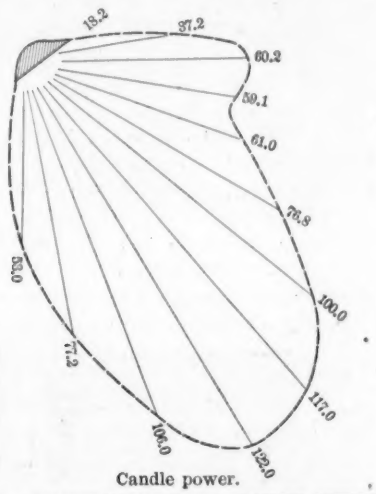


FIG. 22.—DISTRIBUTION FROM TROUGH REFLECTOR.

15 and 15A. Both of these types of reflectors are much used for window lighting. The X-Ray reflector apparently has much the best of it in this test, not so much in maximum candle power as in the wide angle over which this maximum candle power is distrib-

FIG. 22A.—TROUGH REFLECTOR.

uted. It is conceivable, however, that there might be some locations where the 60-cp thrown by the window trough reflector in a direction slightly below the horizontal might be of use in lighting the upper part of the window. This is a matter to be determined by the conditions under which the reflector is to be used.

Electrically-Operated Pillar Cranes.

BY CHAS. SMITH.

IN the operation of factories and shops as well as iron and steel works, the application of electricity has been of special value as a motive power for hoists and cranes of both the traveling and fixed types. Where electric power is available and is used for other purposes as well, it is generally conceded that such power is preferable for this service, flexible cables being more desirable than the rigid piping formerly used for pneumatic and hydraulic cranes, while those operated by steam have still more serious drawbacks, each crane requiring a separate steam engine and boiler which continually wastes fuel for long periods in order to keep steam up even when not in use. The electric crane, therefore, is utilized more extensively than the other forms, which are only employed when certain conditions require it.

It may be of interest to consider some of the details of construction and methods of operation of that form of electric crane known as the pillar crane. Fig. 1 shows an electric pillar crane of American construction with covered trolley for out-of-door service. The current is conducted to the hoisting and traveling motors by four horizontal wires on the top of the crane through trolley wheels, as shown in the illustration. The controlling apparatus is mounted in the cab noted at the side of the pillar, the whole apparatus being protected from the weather as the crane is designed for yard service for large manufacturing plants.

Fig. 2 shows a pillar crane employed for indoor service, which was constructed in Berlin, Germany, by Becker, and electrically equipped by the Elektricitäts Actien Gesellschaft, of Frankfort. It has a lifting capacity of 7.5 tons, and is utilized in the boiler shop of Henschel & Son, of Cassel, Germany. The controlling mechanism is mounted near the base of the pillar within easy reach of the operator. The driving motor is mounted on the top of one arm of the pillar crane, from which point it drives by gearing and chains the swinging and hoisting motion employed in the regular service of the mechanism. The hoisting hook is suspended from a carriage on a long arm of the pillar crane, the hoisting of the hook and movement of the carriage on the arm being controlled by the wheels shown at the base of the pillar.

Pillar cranes are very largely used in iron and steel works as well as in machine shops, boiler houses and yards of manufacturing

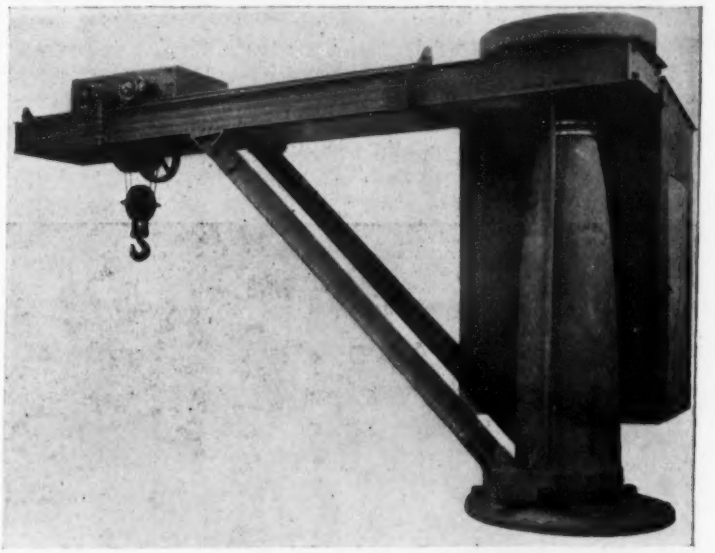


FIG. 1.—AMERICAN ELECTRIC PILLAR CRANE.

plants, where the fixed types of pillar cranes are more largely employed. Fig. 3 shows the construction and indicates the methods of operation of an interesting type of German movable pillar crane as utilized for removing ingots from the soaking pits of modern European steel works. This crane was constructed by the Gesellschaft für Elektrische Industrie, of Karlsruhe, I. B., Germany. This "velocipedkran" or gantry traveler has a capacity of 3.5 tons, with a hoisting speed of 15 meters per minute. The carriage mounted on the swinging arm of the pillar crane, as noted in the illustration, is operated by a three-phase motor. The carriage operates at a speed of 17 meters per minute, while the arm swings with the pillar, 2.1 rotations being the maximum per minute, this motion being supplied by another motor geared to the pillar at its base. A third three-phase motor of 7 hp capacity is utilized for moving the pillar crane on its track, the travel being at the rate of 35 meters

FIG. 2.—GERMAN ELECTRIC PILLAR CRANE.

per minute. All of the movements of the pillar crane are controlled from the operator's stand on the base of the crane. The hoisting hook is operated by a 20-hp motor mounted on the carriage, the greatest radius of action being 12.9 meters and the shortest radius of action being 3.4 meters. The total height of this pillar crane is 6.078 meters, while the height to the top of the swinging arm is 5.048 meters, and the maximum height to which the hook may be raised is 4.05 meters.

The universal controller employed is so designed that by the movement of a single lever the hoisting and swinging motions are controlled in harmony with the movement of the lever. The three chief movements are effected by means of three reversing regulators by applying a universal crane controller which permits the performing of two movements of the crane with one single steering lever. The zero position of this lever is the horizontal one; when moved upward the load is raised; if turned to right or left the load follows the same direction; if turned in an upward direction and to the right, the load follows a corresponding movement; if a circle be described by the lever the load performs a circular movement.

This steering apparatus differs from an ordinary street railway controller only in that it is constructed with two cylinders, which, through the medium of cog wheels, may be turned by the lever either singly or both at the same time. The resistance is mounted separately in each case. In some special cases the universal steering

FIG. 3.—GERMAN ELECTRIC PILLAR CRANE AT STEEL WORKS.

apparatus is provided with a third cylinder for the third movement, which is set in motion by means of a separate small lever. But in a general way the use of a special reversing regulator quite suffices for the third movement. In this way the man in charge of the crane can, by the aid of his two hands alone, direct the three movements of the crane simultaneously. All the movements are thus centralized and are directed by a single man. In the case of traveling cranes, and more particularly where very rapid running is required, the steering apparatus is kept in the bunk immediately below the crane bearer. The elevated position of the man in charge affords him an extensive view of the whole field of operation, thus enabling him to work rapidly and with distinct aim. It goes without saying that good quality and durability of the steering apparatus on the one hand, and, on the other hand, its exact adaptation to the requirements of each individual case, are most important factors in the successful handling of cranes on a large scale.

It is a necessary condition of rapid manipulation that the steering apparatus be graduated to a fine scale. Well constructed cranes must deposit their loads upon the desired spots to within half an inch straightaway and without any prior uncertain attempts. In order to more fully insure this result the starting gear of cranes is provided with automatic electromagnetic brakes.

New Telephone Patents.

CENTRAL OFFICE APPLIANCES.

Mr. Frank B. Cook, of Chicago, has brought out one more form of sneak current protector, this being a modification of one of his earlier types designed upon the self-soldering plan. With this present design a high-resistance carbon conductor of cylindrical shape is included in the circuit to be protected. This cylinder is held in a spring holder restrained against rotation about its axis. Near the middle of the cylinder is a groove into which there is sprung a metallic ring having a serrated surface. This ring will rotate freely on the cylinder, except when secured in position by a fusible wax or solder. The actuating spring catches in one of the teeth of the ring and through it completes the electric circuit. If sufficient current flows to heat the fusible material it lets go, the ring slips and the operating spring snaps off and opens the circuit. As the cylinder cools the adhesive sets, securing the ring in a new position ready for re-use.

With lamp switchboards, the lamp cap and lamp cap symbol have always been a study. Some use an opalescent bull's eye cap which can be seen from any direction. Such a cap is difficult to mark, however. Internal markings have failed, while external ones must be cut in the glass and filled in. Another type of cap carries a plane window, and T. V. Davis, of Kansas City, has invented a plane cap with changeable markings. These markings are upon thin templates, which fit over the face cap of the cap proper, being secured in position by a guard ring which slips on over the extremity of the lamp cap holder. Mr. Davis has assigned his patent to the Stromberg-Carlson Company.

The Western Electric Company has obtained by assignment a patent recently issued to F. R. McBerty, of Evanston, Ill., for a special type of switchboard signal. The vane is controlled by two armatures. The weight of one of these, the upper one, as shown

FIG. 1.—M'BERTY SIGNAL.

in Fig. 1, normally holds the vane obscured. When this armature is attached into the forward position the vane falls by its own weight. When the lower armature is actuated the vane is again obscured, being raised by a stud on the second armature.

SWITCHBOARD CIRCUIT.

In Fig. 2 is shown a switchboard circuit for a common battery two-wire system. It is worked out with an auxiliary intermediate

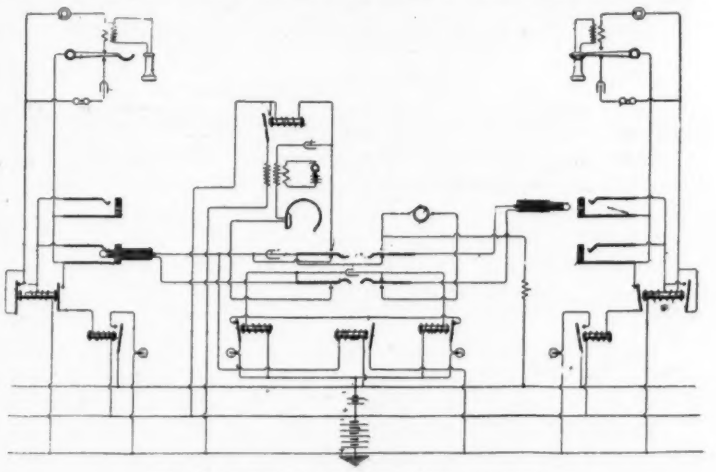


FIG. 2.—WEBSTER SWITCHBOARD CIRCUIT.

potential to give a suitable busy test. In this arrangement of circuits a differential cut-off relay is used, which fails to operate until a plug is put in a line jack. It may readily be traced how this unbalances the two relay windings and how the relay in operating completely shunts out one of its windings and thus remains locked as long as a plug is in its jack. The general principle of operation of both cord and line circuits and the design of the former are well understood. H. G. Webster, of Chicago, is the inventor of this circuit, the Stromberg-Carlson Company having been assigned the patent.

BINDING POST.

Still another patent assigned to the above company is that of William Kaisling for a binding post of improved construction. This post has a brass base threaded to receive the clamping screw. This latter is a screw with a shank of reduced size upon which is placed a washer, too small to pass over either head or thread. It is at once seen that as the screw is slacked off the washer travels with it, leaving a clear space between the washer and base within which to insert a wire. The troublesome tendency of a washer to stick to the base is effectively overcome.

SUBSCRIBER'S CIRCUIT.

It is a well-recognized fact that with common battery systems to obtain the maximum of uniformity of transmission with lines varying widely in resistance, the constant part of the resistance must be as high as possible. On the other hand, as this rises the total resist-

ance rises to the detriment of the average transmission. In order to avoid the latter while retaining the former effect, F. W. Dunbar has invented a subscriber's circuit adapted for use with a very high resistance transmitter—in fact one with a normal resistance of several hundred ohms. Such a transmitter will, of course, have a proportionate variable resistance. Mr. Dunbar has arranged his circuits in many different ways, but always includes his receiving and transmitting apparatus in two parallel branches of approximately equal impedance.

INTERCOMMUNICATING SYSTEM.

Mr. Edward J. Hall, of New York City, has patented an intercommunicating system to be operated upon the common battery plan. This is worked out, using two common wires, one battery and one return wire, to which both sides of the telephone circuits are connected. The switch wires are concerned in the signalling only and thus introduce no interference with the talking circuits.

LETTERS TO THE EDITORS.

"London's Telephones."

To the Editors of Electrical World and Engineer:

SIRS:—The remarks published as passed by Postmaster W. R. Wilcox, of New York City, in which it is stated he tells Londoners "their telephone service is the worst he ever saw in any place," deserve comment, as to say what is further stated, that "there is not a Londoner who can say a good word for the telephone service," is very far fetched. As is known to many, in some parts of London the service is as prompt as can be desired. That there is great room for improvement is a sure thing, but look into some of the causes of these remarks, not very complimentary to the telephone authorities of the world's greatest city, when it will be frankly acknowledged, the fault of bad service is not altogether with the telephone authorities. At present, telephonically speaking, London may be said to be undergoing gradual conversion into standard working. The engineering features of its equipment are at present very mixed, there being about five different systems in use, which as every telephone man knows, involves a great deal of complication due to inter-communication details, an absolute necessity for efficient service. These details are unavoidably all such as tend to cut down the rapidity of connecting through, an item which has a large effect on the handling of traffic at centers where the local calls are a very low percentage of the total. In a few years the whole of London's systems will probably be working on the well known "common battery" principle, being on lines much similar to those existent in New York City, which is, without much room for doubt, the city "par excellence" in telephonic matters throughout the world. All of the large exchange centers in the Post Office and several of the National Telephone Company's are on this principle. Thus, in common to the evolution of things, as time goes on, the factor of differing systems with its attendant evils will be eliminated.

The great feature that needs attention by the British telephone user and one that has a great effect on the service is the necessary knowledge of how to handle and transact business through the telephone. What is there to know? may be asked. It is simple, yet very important. Study the instructions issued, act up to the spirit of them, and above all pay attention to your telephone immediately on being rung up. In general, the British public do not seem to take unkindly to the telephone, but certainly as yet do not realize its business value as the American does. Compare the fact that New York City possesses four times the number of telephones that London does. At present the education of the telephone user is a feature much neglected, and where proper instructions are issued, it is common to have them entirely disregarded, to the user's own disadvantage.

However, it seems safe to affirm that the British Post Office in matters telephonic is surely if slowly coming ahead with modern progress, so the time should not be very distant when Londoners may be able to say their telephone system is second to none, and by that time doubtless the public will have fully grasped the necessity of paying as much attention to the proper use of the telephone, as they would when in ill-health to their physician's advice, enhancing the efficiency, while enabling them to realize the true value of the service, a matter never so forcibly brought home as when a serious dislocation occurs, suspending its operation.

NEW YORK CITY. A. L STANTON.

Belgian Single-Phase Railway.

To the Editors of Electrical World and Engineer:

SIRS:—In your issue of October 21, 1905, there appears at the foot of page 697 a note stating that you have been informed by Mr. Latour that the motors of the Borinage Railway in Belgium are of the Latour type. The letter from Mr. Latour which appears on page 701 conveys a wrong impression as to the true state of the case.

We beg to inform you that the motors in question were built by our company as the result of experience gained on our experimental lines in our factory and at Spindlersfeld. They are of precisely the same Winter-Eichberg type as used on the Stubaitalbahn line.

Some of our patents for the Winter-Eichberg system were not secured in Belgium soon enough. The reason for the ambiguity in the patent situation is that Germany was not in the International Patent Union at the time when Mr. Latour's French patents were applied for, France and Belgium having at that time a mutual agreement to acknowledge each other's patents. As the result of this state of affairs the Allgemeine Elektricitäts-Gesellschaft preferred to control the Belgian Latour patents. This is the whole influence which Mr. Latour had on the Borinage motors.

As these Belgian Latour patents cover at most only some details of our system it cannot be said that the Borinage motors are of the Latour type.

BERLIN, GERMANY. ALLGEMEINE ELEKTRICITÄTS-GESELLSCHAFT,

DIGEST OF CURRENT ELECTRICAL LITERATURE

DYNAMOS, MOTORS AND TRANSFORMERS.

Machines at Liege Exposition (Single-Prase Motor).—REYVAL.—An illustrated description of various machines exhibited by the Société Parisienne pour l'Industrie des Chemins de Fer. Most of the machines are for traction service. There is a 34-kw, 225-volt, direct-current generator, various traction motors of different capacities and three-phase and single-phase motors. A single-phase induction motor exhibited is designed by Heyland and starts without any condenser or special external starting device. Its construction is similar to ordinary polyphase induction motors and the special feature rests entirely in the construction of the stator. The same comprises two windings arranged like the phases of a two-phase motor. Their reactances are made as different as possible and at starting the two windings are connected in parallel. The one winding, which is the principal one, is placed in numerous open slots, while the second auxiliary winding, which is used only at starting, has only a single slot per pole and the slot is entirely closed. This construction results in differences of self-induction in the winding, resulting again in different phase differences between the e.m.f. and the current in the two windings. This results in the revolving flux which turns the motor. The motor gives at starting a torque equal to that corresponding to normal running. At that moment the sum of the current absorbed by each of the two phases is not more than double the normal current at full load, if the frequency is not more than 60 periods, and about 2½ times that value if the frequency is 100 periods per second. When the motor starts without load, the starting current is not more than the normal current in the first case; it becomes 1½ times this value in the second case. The starting rheostat is of the normal type as far as the insertion of resistances in the rotor circuit during starting is concerned, but it also comprises another device operated by the same handle, which cuts out automatically the auxiliary phase when the speed of rotation of the motor has become sufficiently high.—*L'Eclairage Elec.*, October 28.

Alternator.—HOPKINS.—An illustrated article showing how to build a small alternating-current dynamo without castings.—*Scien. Am. Sup.*, November 11.

LIGHTS AND LIGHTING.

Flame Arc Lamp.—An illustrated description of the "Oriflamme" arc lamp exhibited by Oliver & Co. at the Olympia Exposition in London. The chief difficulty of flame arc lamps is the rapid consumption of the carbons. Within certain limits the greater the relative size of the flame-producing core, the greater the efficiency of the arc; but at the same time, the greater the proportion of the core, the more rapid is the consumption of carbon. In the present lamp a "magazine" is used holding eight or nine pairs of carbon, each twelve inches long. These are of exceptionally small diameter, but the proportion of the total section taken up by the core is greater than in ordinary flame lamps. Since the carbons are of smaller size, it is possible to use carbon of comparatively poor quality without impairing the steadiness of the arc, and it is claimed that the cost of carbons does not exceed 0.18 cent per lamp-hour in a 9-amp. lamp. Each pair of carbons burns five hours. The carbons are placed in two boxes, inclined at an angle of 22°. They are put in at the back and pressed forward by a pair of arms controlled by a spiral spring. The right-hand diagram of Fig. 1 is a sketch of one of the magazines,

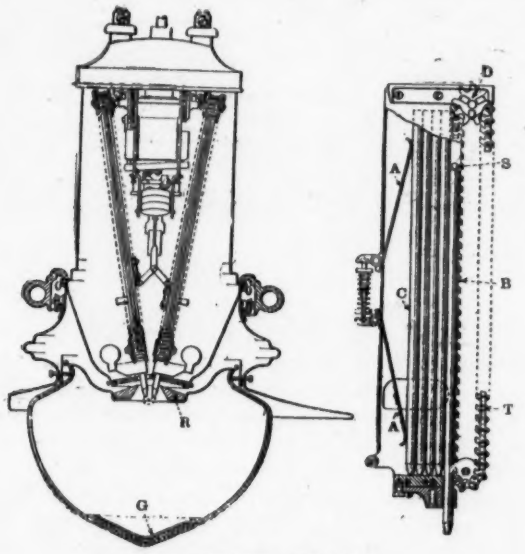


FIG. 1.—FLAME ARC LAMP.

the arms, *AA*, pressing against the carbons, *C*. The front carbon emerges from the magazine as seen, and is pressed forward by the stud, *S*, fixed on a chain, *B*. It is this chain that feeds the lamp, being turned by the sprocket wheel, *D*. There are two studs, *S* and *T*, on this chain. In the position seen in the sketch the stud, *S*, is pressing down the carbon as the lamp feeds by the travel of the chain. When the stud reaches the bottom the carbon is ejected and the next one takes its place, and the second stud, *T*, has at that moment reached the top of the carbon and presses it down as the chain travels. In the left-hand diagram the general arrangement of the lamp is shown. *R* is a reflector which is designed to prevent the deposit of the products of combustion on the globe of the lamp. It is of porcelain in a copper spinning, and rests on the rim of the globe on three distance pieces. By this arrangement there is an upward draught of air through the hole in the reflector and the products of combustion are deposited above. An ash tray, *G*, catches the short ends of carbon.—Lond. *Elec.*, October 20; *L'Industrie Elec.*, November 10.

Arc Carbons.—SOLOMON.—An abstract of a paper on the manufacture of arc carbons. The arc lamp carbon of the day differs very little from the early forms and the process of manufacture is also practically the same. Nearly all carbons then contained about 75 per cent of gas carbon and 25 per cent of soot, gas tar being employed at present, instead of syrup as formerly. The author described the various processes of grinding the retort carbon to pebbles, and finally to dust, by means of an octagonal box containing heavy steel spheres. Tar of the correct quality, although not treated in any way, is exceedingly difficult to obtain. The mixing process is carried out by means of a dough-mixing machine, and the mixture subsequently passed between rollers, so as to distribute the tar evenly. Finally, the material is moulded into large cylinders, forced through a nozzle by means of hydraulic pressure, cut off into lengths of a little over a meter, and then baked. After baking the rods are cut up into pieces of any desired length, sorted, ground to length and pointed. The author mentioned that carbons for use in open-type lamps out of doors have a large proportion of retort carbon; those for use in the same lamps indoors are composed of about equal parts of carbon and soot, while a third class for enclosed lamps is nearly all soot. The materials have to be very pure and clean, and the soot has to be specially made. The author gave some results of tests of carbons made by the British General Electric Company and by firms in Continental Europe.—Lond. *Elec.*, November 17.

Electric Candle.—Among notes on the recent Olympia Exposition in London a new candle fitting of Bonnella & Son is mentioned. This lamp has been designed to meet a demand for a correct and effective initiation of an ordinary wax candle. The lamp, as shown in Fig. 2, consists of three parts, viz.: the interior, the lamp and the opal tube, all of which are renewable at a small cost. The interior is formed of an inner and outer metal case, insulated from each other by a glass tube, and connected at one end to the two terminals of an ordinary S.B.C. cap. On the upper end of the outer tube is screwed a spring clamp, which makes contact with the outer contact of the lamp, the inner tube receiving the pin or second contact of the lamp. It will be seen that the light passes for only a short distance down the opal covering, thus giving it the appearance of a lighted wax candle when a shade is fixed over the lamp. A special spring socket or holder is supplied for fitting into the sconces of pianos, etc., three springs projecting from the outside and holding the socket tight when pushed into the sconce.—Lond. *Elec.*, November 10.

FIG. 2.—ELECTRIC CANDLE.

POWER.

Hydraulic Station.—HERZOG.—A well-illustrated description of the water power plant utilizing the falls of the Morobbia mountain stream and supplying power to the city of Bellinzona. There are three three-phase, 660-hp alternators. The voltage is 5,500 and the frequency 50. The results of the tests of the alternators are given in detail.—*L'Eclairage Elec.*, October 28 and November 4.

High-Tension Transmission.—SCOTT.—Some notes on new extensions of the system of the Missouri Power Company in Montana. The most interesting feature is the use of 70,000 volts for transmission. A brief description of the insulators and pole construction is given.—*Elec. Jour.*, November.

Electricity for Mines.—RANDOLPH.—An illustrated article on colliery and mining switchgear for high and low-tension, alternating-current service.—Lond. *Elec. Rev.*, November 3 and 10.

Turbo-Generator.—REYVAL.—A description of a generating set, exhibited at Liege. It consists of a Union steam turbine of 300 hp, running at the speed of 3,000 r.p.m., and a Helios direct-current dynamo. Only the steam turbine is described.—*L'Eclairage Elec.*, November 4.

Steam Turbine Plant.—An illustrated description of the new plant at the Port Dundas generating station in Glasgow. The present plant comprises two Parsons steam turbines directly coupled to 3,000-kw, three-phase alternators.—Lond. *Elec. Rev.*, November 3.

Cleaning Blast Furnace Gases.—KRULL.—An illustrated description of a new apparatus devised by Bian for cleaning and cooling blast furnace gases.—*Glueckauf.*—October 28.

Work of Windmills.—RINGELMANN.—An account of determinations of the relation between velocity of wind and speed of revolution of windmills employed for raising water. The experiments extended over two years and were made with a pump having 72 vanes, 1.3 meters long, with a total surface of 9.4 square meters. The pump was left to its own working all the time, being self-turning and self-regulating and going out of gear with a wind velocity exceeding 10 meters per second. The ratio between the velocity of the vane rim and the wind varied from 0.82 at 4 meters per second to 0.75 at 10 meters. The volume of water raised 10 meters was 1,566 liters per hour at the former speed and 3,527 liters at the latter speed.—Lond. *Elec.*, November 17; from *Comptes Rendus*, October 30.

TRACTION.

Heavy Electric Traction.—An article referring to a recent communication of Parshall to the engineering supplement of the London *Times*, of November 1. He is a supporter of the three-wire, direct-current system for the electrification of suburban railways. For the lighter class of railways working over considerable distance with moderate acceleration and moderate tonnage, he thinks that a single-phase system has certain advantages. "As regards first cost third-rail is much cheaper than the ordinary overhead system; as regards reliability, experience is in favor of the third rail." Parshall claims as disadvantages of the single-phase system the drop in the return circuit if not insulated; disturbances to telegraphic and telephonic apparatus and such a low power factor and low efficiency which must counterbalance the energy losses in transformation of polyphase to direct current, in the system at present generally adopted for traction purposes. Parshall suggests that for rapid acceleration and for short runs the direct-current is preferable to the single-phase. Reference is made to Sprague's stand taken with respect to the New York, New Haven & Hartford Railway's decision to install single-phase locomotives. The editorial writer does not seem to agree with these views of Sprague and Parshall. He states that a single-phase system, if properly installed, will have over its whole range of operation a power factor which should not fall below that obtainable with the direct-current system, and rotary converters. Further, alternating currents are much less liable to cause electrolytic and similar damages. The overhead system is not more costly than third-rail or fourth-rail installations, if applied to suburban lines and around large towns. As regards rapid acceleration, where the motors have been scientifically designed with the primary object of making them satisfactory alternating-current motors, and not merely good direct-current motors, which can work more or less efficiently on alternating-current lines, the average acceleration during the whole period of acceleration is at least as favorable, if not more so, with the single-phase as with the direct-current. Fig. 3 gives the results

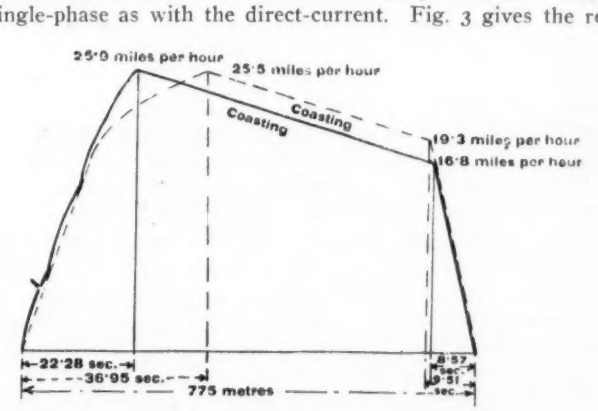


FIG. 3.—DIAGRAM OF TESTS.

of tests of the Allgem. Elek. Ges., made to compare single-phase and direct-current traction. The train in each case consisted of six coaches, each train being equipped with eight motors, and the run was one of 775 meters (847.5 yards) on the level. The dotted curve refers to direct current, the drawn-out curve to single-phase. It will be seen that whereas with a single-phase motor the accelerating line is practically straight, giving an even acceleration throughout the whole period of acceleration, in the case of the direct-current motor a little after half the period of acceleration, the latter rapidly falls; the result, as far as short-distance journeys are concerned, therefore, being all in favor of the single-phase motor.

	Direct current.	Single-phase.
Watt-hours per ton-km	42.2	39.3
Average efficiency	73.6	74.2
Average power factor	..	.816

With direct current supplied from a high-tension polyphase station through rotary converters, the average power factor over the whole system would not appreciably exceed 82 per cent.—Lond. *Elec. Rev.*, November 17.

New York Central Electrification.—A very well-illustrated article describing the proposed track lay-outs on the new Grand Central Station of the New York Central Railroad in New York. This station will not only be the largest and most complete of any in the world, but will also be unique in that it is designed exclusively for electric trains. Following the description of this station is a full account of the power distribution system to be used in the electric zone of the New York Central Railroad.—*St. R'y Jour.*, November 18.

Three-Phase Versus Direct-Current Traction for Trunk Railroads.—KOROMOZAY.—A comparison of the relative advantages of the three-phase and direct-current systems for electric traction on main railroads. The author compares first cost, working cost, security of service and elasticity of service. He is in favor of the three-phase system. Some comparative figures for first cost are given for the Valtellina three-phase line and the Milan-Gallarate-Porto-Ceresio direct-current road. For the former the first cost was 12,000 francs per kilometer; for the latter 27,380 francs. The first cost of the three-phase line is, therefore, less than 50 per cent of that of the direct-current line.—*L'Eclairage Elec.*, October 28.

Brakes.—Two reports on brakes presented before the Association of German Street Railway & Light Railway Companies. The first report by Scholtes is in favor of the electric brake and some of his conclusions are as follows: The first cost of the electric brake is less than that of the air brake, and its maintenance cost is lower than even the hand brake. This is due to the less wear of the brake shoes, which are used only after the car has already been braked electrically. Electric braking requires simply a somewhat larger controller and more closely graduated resistances. On trail cars the solenoid brake is now considered preferable to the disc type. The second report is written by Bjorkegren and is rather in favor of air brakes. The proper operation of the electric brake is said to demand a certain degree of skill. The air brake has given the better results on low city speeds and the electric brake on high city speeds. It appears also that the stops are smoother and the jolts less marked with the air brake than with the electric brake. Judging from the experience on the Berlin railway Bjorkegren asserted that on similar systems either brake was equally reliable, as proved from the collision statistics. It was his opinion, however, that for lines with long severe grades, electric brakes should not be recommended, owing to the severe strain put upon the apparatus in trying to stop a runaway car. The use of air brakes on such lines makes it possible to have independent braking for the trailers. Air brakes should also be preferred on high-speed interurban runs with heavy cars. Consequently it may be concluded with regard to reliability that the air brake satisfies all operating conditions and the electric brake only a limited set of conditions. Both authors give some interesting statistics on first cost, maintenance and extra current required on account of power braking.—*St. R'y Jour.*, November 18.

Combined Electric and Steam Traction in Hungary.—A note stating that the railway which is at present being built between Miskolez and Diosgyör will normally be operated electrically, but the traction peaks (which are very pronounced) will be dealt with by three steam motor cars besides. This arrangement has been adopted to reduce the cost of electrical plant, especially in connection with the distributing system. Ganz & Co., who are the contractors for the electrical portion, will also supply the three 80-hp steam motor cars, which are to haul several trailers.—Lond. *Elec.*, October 27.

Freight Tunnel in Chicago.—An illustrated article giving some information concerning recent developments on the elaborate system of freight tunnels underlying the central business district of Chicago. The purpose is to relieve the congested streets above of a great deal of teaming by conveying coal, ashes, earth from buildings and excavations, freight, merchandise and mail matter by means of narrow-gauge electric railways in the system of tunnels. Thirty-nine miles have so far been completed. As yet the tunnels are in use only to a limited extent.—*Western Elec.*, November 18.

Block Signals.—KOHLFUERST.—An illustrated description of Grassman's block signal system for single-track railroads.—*Dingler's Polyt. Jour.*, November 11.

Trolley Wire Suspension.—An illustrated description of a new flexible suspension for grooved trolley wire.—Lond. *Elec.*, November 10.

Railway Motors.—SCHOEPF.—An illustrated article of a general nature on the installation and care of railway motors.—*Elec. Age*, November.

INSTALLATIONS. SYSTEMS AND APPLIANCES.

Automatic Voltage Regulator.—In notes on the recent Olympia Exposition in London the Chapman regulator is described. The principle on which this regulator works is the automatic adjustment of a resistance placed in the field magnet circuit of the generator.

The regulator consists essentially of three parts—a rheostat, a working solenoid to operate the rheostat, and a relay to detect any slight variation in voltage. According to the size of the generator to be governed, the rheostat is composed of from one to four sets of coils, each being connected to a set of segments numbering from 41 to 61 in a set. German silver is the material used for the coils, which are stretched between slate plates. The segments of the rheostat are made of rolled copper and are arranged on top of the working solenoid side by side, insulated by mica, and resemble a flat commutator. A German silver brush moves over the upper surface of the segments, and is operatively connected to the core of the working solenoid. The working solenoid (Fig. 4) consists of two

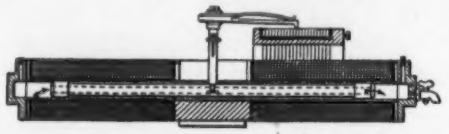


FIG. 4.—VOLTAGE REGULATOR.

differentially-wound coils of wire mounted on a brass tube. Inside the tube is placed an iron core, cone-shaped at either end, and adapted to serve a double purpose: that of a magnetic movable core, and that of a piston in a cylinder. The ends of the tube are closed, and the space inside the tube at each end is filled with oil. It is clear that the core can move only as it displaces the oil. A passageway is provided for the oil to pass from one end to the other, and a valve is arranged in the passage for adjusting the freedom of flow of the oil. As may be gathered from the illustration, the vertical plunger is controlled by a small thumb nut. By this means the rapidity of movement of the core may be checked to any desired extent to adapt the movements of the regulator to the characteristics of the particular generator to which it may be connected. The valve should be set just tight enough to prevent "hunting." Each of the two coils composing the working solenoid is made up of three sections of wire; an inside section, an outside section and a middle section. The inside section and outside section are connected as one, and the number of turns of wire in the two together is exactly equal to the number of turns of wire in the middle section. Under normal conditions, with the relay balanced, there is a current flowing only through the middle section of each coil. This magnetizes the core strongly and pulls it equally in opposite directions, so that it remains indifferently in any position where it happens to be. The relay has two platinum contacts. Should the voltage rise 1 per cent, the relay armature abuts against one of the platinum contacts, thus admitting current to the inner and outer sections of the coil at the right-hand side of the regulator; this exactly neutralizes the magnetic effect of the current already in the middle section of that coil, and the core then moves in response to the pull of the middle section of the left-hand coil. If the voltage drops 1 per cent below normal, the relay makes contact on the other side and the core is pulled the other way; and since the sections of the large solenoid are exactly

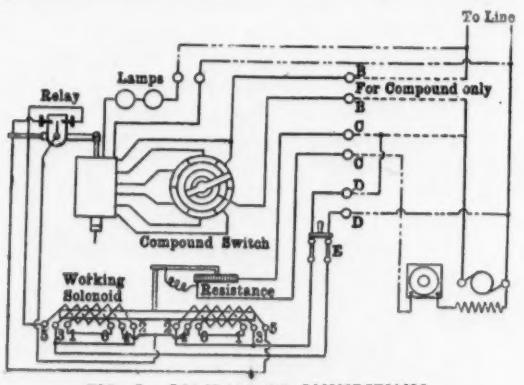


FIG. 5.—DIAGRAM OF CONNECTIONS.

balanced against each other, the effects of self-induction are entirely neutralized, and there is no spark at the platinum contact points. The diagram of the connections is shown in Fig. 5.—Lond. *Elec.*, November 3.

Central Stations in Australasia.—A statistical list giving detailed information on the management and equipment of electric supply stations in Australasia, corrected to August, 1905. Fifty-two stations are mentioned. The largest one is the Melbourne municipal plant of 3,184 kw capacity.—*Australian Hardware and Mach.*, September 1; Lond. *Elec. Rev.*, November 3.

Lightning Arresters.—A report of a committee of the Franklin Institute on the Shaw lightning arrester.—*Jour. Franklin Inst.*, November.

ELECTROPHYSICS AND MAGNETISM.

Congress of Radiology.—An account of the proceedings of the first International Congress of Radiology and Ionization, held in Liege from September 11 to 16, 1905, with abstracts of the following papers presented: Riecke, on the absorption of the rays from radium and polonium; Angström, on the heat given off by radium; Himsted and Meyer, on spectrum analysis of the light emitted from radium bromide crystals; Wiedemann and Wehnelt, on an easy method of investigating the metallic vapor spectra of discharge tubes; Mathies, on potential measurements in tubes without electrodes; Mache and Meyer, on the radioactivity of Austrian thermal spring waters; Blanc, on the radioactive elements contained in the sediments of the thermal springs in Echaillon and Salins-Montiers (Savoie); Tommasina, on the radioactivity of the lava of the 1904 eruption of the Vesuvius; Sarasin, on the radioactivity of air from springs; Sarasin, Tommasina and Micheli, on an investigation of the Elstea and Geitel phenomenon of induced radioactivity; Brunhes and Baldit, on the dissipation of both electricities on tops of certain mountains; Barus, on the properties of condensation nuclei and their distribution in the atmosphere; Lewis, on the velocity of ions in the gases of colored flames.—*Phys. Zeit.*, October 26. Paper by Righi on the electrification of bodies subjected to radium rays.—*Phys. Zeit.*, November 9.

Excited Activity.—MAKOWER AND JACKSON.—Two papers, in the first of which Mackower gives a result of an experimental investigation of the method for transmission of the excited activity of radium to the cathode. He arrives at the hypothesis that the molecules of excited activity, initially uncharged, are projected from radium emanation with velocities large compared with those of gas molecules, and at a certain percentage of encounters with the gas molecules a negative electron is shot off, leaving the activity positively charged. The paper by Jackson is chiefly mathematical.—*Phil. Mag.*, November.

Electric Wind.—SCHAFFERS.—An account of an experimental investigation of the complex nature of what is generally called electric wind. In most cases it is due to three different causes. The first is the change of form of a liquid conductor under the action of influence and of the ordinary attraction. The second is the repulsion of the point to the charge of equal sign given to this conductor. The third is the effect of the air being carried along with the moving electric charges, i. e., the ions. The last cause is generally considered exclusively, but it is not the main cause. The second cause always appears to be predominant.—*Phys. Zeit.*, October 1.

Path of Cathode Rays.—WEHNELT.—If a cathode is passed through a homogeneous electrostatic field the theory requires that the path of the ray is a parabola. The author shows how this may be easily demonstrated by experiments.—*Phys. Zeit.*, October 1.

ELECTROCHEMISTRY AND BATTERIES.

Traction Storage Cell.—Some notes on the Girard and Fiedler lead storage cell for which some remarkable claims are made, although not vouched for by the editorial writer. It is claimed that 1 hp-hour can be obtained from a cell weighing only 16 kg., an output equivalent to more than 21 watt-hours per pound. The battery is charged in a period not exceeding 2 hours. A battery which when discharged in 10 hours gives 360 amp.-hours, is claimed to give 180 amp.-hours when discharged in one hour. The amp.-hour efficiency is claimed to be practically constant, no matter what rate of charge or discharge is adopted. The plates are of the pasted type.—Lond. *Elec. Rev.*, November 10.

Metallic Calcium.—GOODWIN.—An account of experiments in which he obtained metallic calcium by electrolysis of fused calcium chloride with a hollow cylindrical anode vessel of graphite. As cathode he used an iron rod on which the calcium is deposited; this rod is gradually raised during electrolysis in order to prevent the calcium from redissolving in the electrolyte.—*Jour. Am. Chem. Soc.*, November.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Modified Braun Tube.—WEHNELT.—An illustrated description of a highly sensitive modification of the well-known Braun cathode-ray tube. He uses the "soft" rays which are given off from incan-

descent metallic oxides (CaO, BaO, SrO) as cathodes in discharge tubes. The new Braun tube is designed for magnetic and electrostatic deviation and its construction is shown in Fig. 6. *K* is the

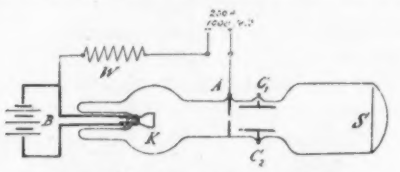


FIG. 6.—CATHODE-RAY TUBE.

cathode consisting of a narrow strip of platinum foil which is brought to incandescence by the current from a few storage cells, *B*. On the platinum strip there is a spot of CaO of several square millimeters. The anode, *A*, has a very small opening in the center. If *K* is heated and *A* is connected with the positive and *K* with the negative pole of a source of current of several hundred volts with suitable resistances in series, the CaO spot on *K* sends out an intense bundle of cathode rays. The perforation, *A*, allows only a well-defined ray to pass. C_1 and C_2 are condenser plates. The ray produces a well-defined bright fluorescent spot on the screen, *S*. This spot is the brighter the greater the difference of voltage used for producing the cathode rays. The author recommends voltages between 200 and 1,000. Corresponding to the relatively low voltages used, the rays can be easily deviated magnetically as well as electrostatically. The vacuum of the tube must be as perfect as possible since the rays ionize strongly; the gas and the ionization is the greater the greater the density. This new type of Braun tube is recommended as useful in all cases in which the high electrostatic potentials of the ordinary Braun tube are a disadvantage; moreover, the velocity of the cathode rays and the sensitiveness of the tube may be easily varied within wide limits by regulating the temperature of the cathode and by properly selecting the voltages applied.—*Phys. Zeit.*, November 1.

Equipment of Meter Testing Departments.—GERHARDI.—In the continuation of his long illustrated serial on electricity meters the author deals with instruments, apparatus, accessories for meter testing departments. He first refers briefly to the Kelvin balances, voltmeters, potentiometers and standards of time, and then deals at greater length with frequency meters and apparatus for measuring the torque.—Lond. *Elec.*, November 10.

Transformer Tests.—DRUCBERT.—A discussion of various transformer tests. He first deals with the determination of the variation of tension and describes the method of Kapp and the construction of the diagrams of Kapp and Arnold. He then discusses the determination of the increase of current. Diagrams are given and numerical applications are made.—*L'Eclairage Elec.*, November 4.

Testing Converters.—BERCOVITZ.—An illustrated note on tests of converters.—*Elek. Anz.*, November 9.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Telegraphy and Telephony.—GAVEY.—The conclusion of his presidential address to the British Institution of Electrical Engineers. The first part of the address was mentioned in the Digest last week. In the second part the author gave a review of the development of wireless telegraphy; he believes that wireless telegraphy is not under any circumstances to supplant or even to compete seriously with inland methods of communication. But there is an important sphere of utility for communication from ship to shore and from ship to ship. For communication between neighboring coasts there is also a possible future, but this depends almost wholly on the further development of the methods of syntony or tuning. The speaker then discussed developments in overground and underground telegraph line construction and gave a review of the enormous increase of the telephone industry. He spoke up strongly for the "milliampere man" and pointed out how wrong the occasional tendency is to look upon telegraphs and telephones as a little apart from serious engineering undertakings. "When modern telephone practice is considered it will be found that in the complexity of the system the amount of electrical energy used for the purpose of signaling and the extent of the works undertaken, a telephone system regarded from the engineering standpoint is in no degree behind any other electrical enterprise." The author gave a review of the development of long-distance telephony with special reference to Pupin's system. He also gave the results of interesting experiments made by the British Post Office, exhibiting graphically the attenuation which in practice takes place under varying conditions. Two circuits were selected, one of one mile and the second of 20 miles of the same cable. An oscillograph was used for observing simultaneously the curves due to the action of the induction coil at the transmitting end and the corresponding curves at the receiving ends of the circuits. A number of letters, both vowels and consonants, were rapidly spoken into the transmitter and the respective transmitted and received curves for each were recorded in the usual photographic manner. Fig. 7 gives the results for the letter *E*. It will be seen

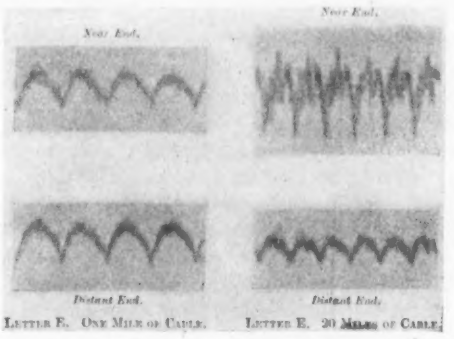


FIG. 7.—TELEPHONE SPEECH CURVES OF LETTER E.

that on the one-mile length the difference of amplitude at the transmitting and receiving ends is almost inappreciable; and all the irregularities of each transmitted curve are faithfully reproduced at the distant end. With the 20-mile cable the difference of amplitudes at the two ends is most marked, and although it is perhaps somewhat more difficult to compare the shapes of the two curves, they still bear a substantial resemblance one to the other. Of unsolved problems the author mentioned the following: A means whereby telegraphic messages can be received at high rates of speed in type or written character, ready for immediate issue to the public or the press; in wireless telegraphy the problem of perfect tuning; in telephony the invention of an effective telephone relay or repeater and secondly a method of extending the range of communication in submarine cables.—Lond. *Elec.*, November 17.

Speed of Different Telegraph Systems.—LUGINBAEHL.—The author gives the following table on the speed of various telegraph systems:

	Words per hour and per line.	Wires.	Words per wire.	No. of operators at the two ends of wire.	Words per operator.
1. Morse	700	1	700	2	350
2. Sounder	1000	1	1000	2	500
" duplex ...	2000	1	2000	4	500
" quadruplex	4000	1	4000	8	500
3. Hughes	1449	1	1440	2	720
" duplex	2880	1	2880	4	720
4. Beaudot triple ..	4320	1	4320	6	720
5. Baudot - Dubreuil double	4800	1	4800	4	1200
6. Wheatsone automatic q'druplex.	12000	1	12000	18	666
7. Murray, simple...	2880	1	2880	4	720
" duplex..	5760	1	5760	6	960
8. Rowland, octuple.	13440	1	13440	12	1120
9. Mercadier, 2 x 12 posts	12000	2	6000	24	500
Mercadier, dplex.	24000	2	12000	48	500
10. Pollak & Virag...	50000	2	25000	—	more than 1000
11. Siemens	17866	1	17866	13	1374

The data for the systems 1 to 6 are based on observations of the author; the data given for systems 7 to 11 are taken from statements in engineering journals.—*Jour. Telegraphique*, October 25.

Statistics.—Statistical notes on telegraphy and telephony in Great Britain in 1904-5; in Denmark, 1903-4; in the Dutch Indies, in 1902 and 1903; in Switzerland, in 1904. A description of the new Bureau des Telegraphes, in Berne is also given.—*Jour. Telegraphique*, October.

German Cables in the Far East.—MEYER.—Notes on some German cables in the Far East. The section between Shanghai and Tschifu offered considerable difficulties since it contained a portion of 110 kilometers with a depth of the ocean of 7,300 meters. The construction of the cables made by a German company is described.—*Elek. Zeit.*, November 9.

MISCELLANEOUS.

Calculating Temperature Rises with a Slide Rule.—WALKER.—An article showing how a simple and accurate method for calculating changes of resistance of copper with changes of temperature, and vice versa, can be employed by using a slide rule fitted with a suit-

able sliding scale. The method described takes into account the changes of the temperature coefficient with temperature.—*Elec. Jour.*, November.

Electric Furnace Hoist.

By L. Ramakers.

BELOW is given a description of a very interesting electrically-operated furnace hoist, which was constructed recently by the Elektrizitäts-Aktiengesellschaft vorm W. Lahmeyer & Co., of Frankfurt:

The hoist shown in Fig. 1 is a double joist sloping hoist, so that while the contents of one truck is being dicharged into the furnace the other is being filled below in the pit. For this purpose two lines are provided at the loading pit, a coke line and an ore line, so that ore and coke can be handled alternately. With double-lead transmission the hoist is capable of lifting about 2,500 tons in 24 hours, it being assumed that the weight taken by each truck is, say, four tons of ore and two tons of coke or lime, the weight of the truck itself being two tons. The duration of travel of the truck, with a vertical lifting height of 40 m., amounts to about 75 seconds, so that the duration of a loading journey amounts to say 100 seconds, if 25 seconds be allowed for filling the trucks. The

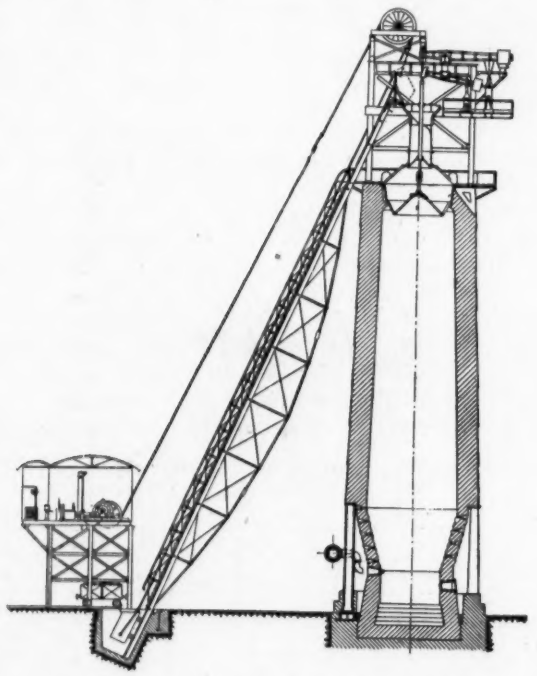


FIG. 1.—VIEW OF HOISTING INSTALLATION.

driving mechanism is so calculated, however, that the hoist is capable of lifting the quantity stated with only one lead, provided the trucks are large enough to hold a load of six tons.

The control of the hoist is perfectly automatic, so that all that is required is to start the ascent and descent, the actual running, stopping and braking being effected automatically and positively by the hoist itself. The driving apparatus is made double, and the connecting up of the whole plant is such that not only can the two motors be used alternately with their corresponding starters, but it is also possible to have an intermittent driving of motors and starters, and likewise a simultaneous driving or working of the motors. The mutual interchangeability of the motors and their distribution or valve motion admits of a continuation of work, even should one of the two parts become defective. The possibility of letting the motors work simultaneously on one countershaft is of special use when, owing to breakage of a rope or damage to the second countershaft the then not counterbalanced weight of the furnace truck and the somewhat greater loading thereof requires a greater power of the driving engine. Of course all precautions are taken against overdriving, slack rope, stoppage of current or breakage of a wire.

The two driving motors are arranged right and left of the rope drums, and their base plates are screwed on to the foundation frame of the winch. The tripartite frame is strongly made of hollow cast iron and held together by flange screws and nuts. Each of the motors has a capacity of 100 hp with a speed of 290 r.p.m., with direct current at 550 volts. In order to obtain as uniform running as possible, even under variable load, and also to secure prompt and exact braking, when the motor supplies return current as a dynamo, the motors are counter compounded.

Clutches inserted in the countershaft enable each of the countershaft halves to be uncoupled with the corresponding motor. The

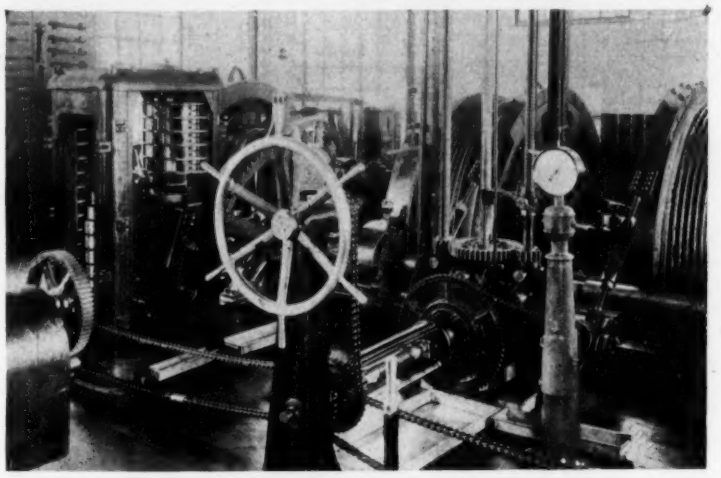
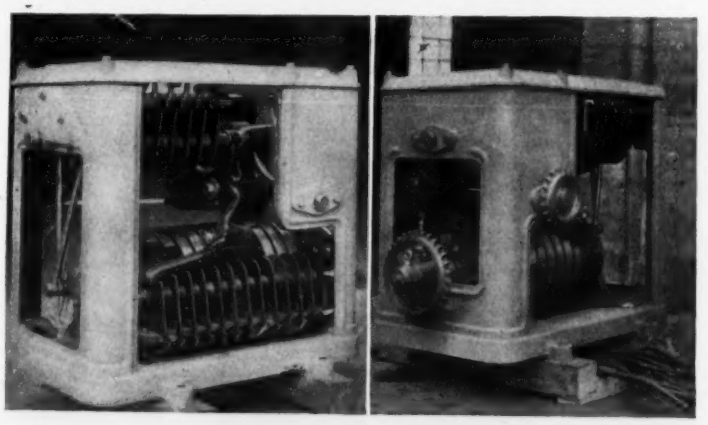


FIG. 2.—VIEW OF DRIVING MECHANISM.

ordinary brake and the emergency brake are made double, so as to render the two halves of the driving mechanism completely independent of each other. The brake discs of the former bear upon the motor axles, while the discs of the emergency brake are cast on to the rope discs direct. The mechanism for the working brakes is fastened with the brake cheeks to the base plate of the winch and, being at the same time dependent upon the driving mechanism, is operated by means of magnets which are mounted upon special cast-iron brackets behind the motors and are intended for a tensile strain of 220 lbs. with a lift of 4 in. The braking magnets are provided with air dash-pots, so as to prevent jolting in switching them on and off. As soon as the motor receives current the brake is taken off, but falls into position again directly the motor is cut out of circuit or when current is stopped for any other reason.

The emergency brake consists of two steel bands lined with wood, which are tightened up by means of a mutual brake lever with weight. It comes into operation directly the truck runs too high for any reason whatsoever. In this case the chucks of the depth indicator lift a rod which draws away a plug from beneath the brake lever, thus causing it to fall and apply the emergency brake. Furthermore, the emergency brake can also be applied by the engineer by hand by the aid of a lever which is placed close to the guiding wheel. The fallen brake weight can be raised again by means of a hand winch, the crank of which can be taken away in the usual manner, and the arrangement is such that the release mechanism automatically snaps into position again.



FIGS. 3 AND 4.—VIEWS OF CONTROLLER.

The depth indicator is located immediately in front of the driver's seat, and, corresponding to the two trucks, is provided with two screw spindles having indicator chucks which show exactly the position at any moment of the ascending and descending truck. It

is driven by means of conic wheels from off the countershaft. Two bells serve as a warning signal when the trucks are approaching the terminal position. In the central axis of the driving mechanism, and permitting of an easy view of the whole mechanism, there is the engineer's platform with the guiding and controlling wheel. The double starters, mounted right and left of the drivers' platform, are connected by means of chain gearing to the guiding wheel and to the driving mechanism.

As mentioned above, the arrangement is such that the driver has only to make the introductory regulating movements, all the others being automatically effected by the hoist itself. The whole of the driving mechanism is shown in Fig. 2, while two views are given of one of the starters in Figs. 3 and 4. It has two contact rollers, one of which is moved by the steam steering wheel and serves as a

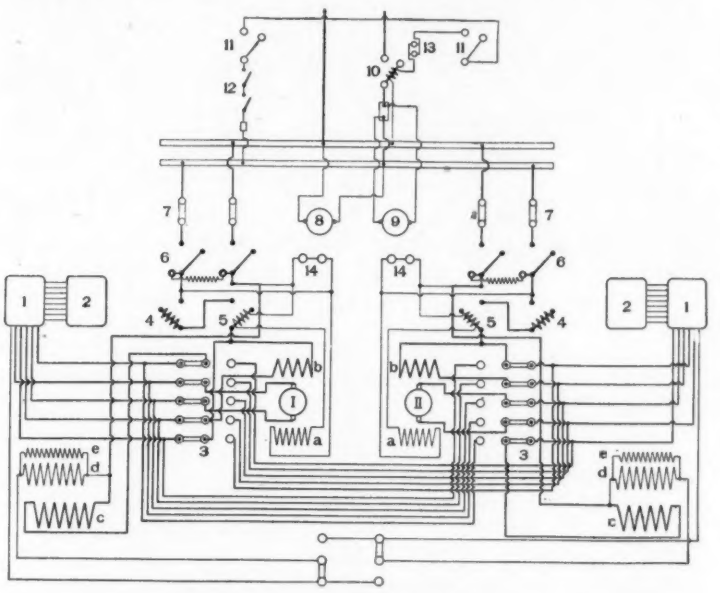


FIG. 5.—DIAGRAM OF CIRCUITS.

connecting up roller, while the second is rotated from off the countershaft by means of chain gearing. The first one, by means of its contacts, inserts resistance so that the motor is just able to start. The second starting roller, driven by the driving mechanism itself, then comes into play and automatically and successively short-circuits the several grades of resistances. The stopping of the lift is effected by a retarding device driven off the countershaft by means of conic wheels; this retarder consists of a powerful screw spindle with nuts held in a guide frame. The small friction of the nuts is not sufficient to turn the guide frame, so that the nut travels on the spindle and its position corresponds at any minute to the position of one or both of the trucks. As soon, however, as the hoist has reached its terminal positions the nut is firmly coupled to an adjustable stop attached to the frame, so that the frame, guiding wheel and putting in circuit roller connected thereto, can now be turned back. Brake contacts arranged thereon cause the braking of the motor as a dynamo, whereby a gentle but positive stoppage of the driving mechanism and of the trucks is effected.

Simultaneously with the aforesaid electric braking of the motor the brake magnets, which are deprived of current on being cut out, throw the mechanical brake upon the motor shaft. Due to the use of both kinds of brakes double safety is obtained. Furthermore, as already remarked, a third brake is formed by the emergency brake acting upon the rope drum, this being released purely mechanically by the nuts of the depth indicator, but it can also be operated from the driver's platform.

The whole of the scheme of connections for the hoist is shown in Fig. 5, where the following notation is used: 1, controller; 2, resistances; 3, reversing bars; 4, maximum switch; 5, minimum switch; 6, cut-out; 7, fuses; 8, voltmeter; 9, amperemeter; 10, minimum cut-out; 11, terminal cut-out; 12, switch against sagging rope; 13, incandescent lamps as resistances; 14, incandescent lamps as resistances; *I* and *II*, motors; *a*, shunt field coils of motors; *b*, main current winding of motors; *C*, brake magnet, main current winding; *d*, brake magnet, shunt winding; *e*, guard resistance. In this connection the following brief remarks may be made: In the current conductor to the bus-bars there is inserted a minimum cut-out switch, which in the event of a return or stoppage of the potential supplied from the central station, breaks the circuit and thus brings the hoist to a standstill by depriving the brake magnets of current.

To the winding of the minimum switch there are connected the anti-sagging switches and the terminal switches provided at the end of the transport path, so that the whole system is also deprived of current and comes to a standstill should the retarding device refuse to act contrary to expectation or should sagging of the rope occur. A second minimum switch is placed immediately in front of the motor, and its winding is laid in the shunt exciting circuit of the motors. These switches also bring the mechanism automatically to a standstill should the excitation of the motors be interrupted by any chance.

Portable Test Set.

BY CHAS. H. COAR.

During the installation of telephone cables it is highly desirable to have some convenient method for selecting and testing the various conductors prior to permanently connecting them to terminals. Quite a portion of the time required for installing cables is expended while making the necessary tests, and for this reason any means which would tend to facilitate this testing should commend itself. A test set adapted for use during the installation of cables in order to be convenient must, first of all, be compact and portable so that it may be readily taken from place to place.

The accompanying illustrations show a set of this description applicable for use about central energy systems, the set in most instances being used from the line side of the terminal rack in the

FIG. 1.—GENERAL VIEW OF SET.

exchange building. The set is self-contained and can readily be arranged for operation in any exchange, or in fact at any point where the proper currents are available.

This set consists of the following apparatus: First, a reversing key (*Rev*) by means of which the terminals of the testing apparatus in the set can be reversed with regards to the circuit under test. Second, a ringing key (*Gen*) arranged in series with an 80-ohm buzzer, the ringing circuit being connected by means of a plug and jack, as shown in Fig. 3. Third, an operator's key (*Oper*) to connect the operator's talking set to the circuit. Fourth, a battery cut-off key (*BC*) which is arranged in conjunction with the balanced relay and battery feed circuits in such manner that its operation affects the relay and battery supply to the circuit. Fifth, a buzz key (*Buz*) which is arranged in such manner that it controls the operation of the relay. Sixth, two testing keys (*VG* and *VK*) for connecting the voltmeter to the circuit. Seventh, four double connecting cords and plugs for connecting the set up through the jacks provided; the cords in this instance are provided with snap clips. Eighth, a balance relay having 250-ohm windings, used as a buzzer in addition to other factors. Ninth, the operator's equipment, condensers, lamp and other accessories which will be described later.

The usual method of testing cables which extend into the exchange building is to connect the various conductors permanently to the terminal rack clips at the exchange, after which the terminal

clip numbers are assigned in any subsequent testing. This method aids matters in most instances, for the cable man can connect his set to a conductor and the man at the exchange rack would locate this conductor by running the test clamp along the terminal clips of the cable under test. One can more readily select the conductors when they are permanently connected.

In describing some of the tests it will be assumed that this method is adopted. The test set is placed at any convenient point on the terminal rack, preferably as near as possible to the cable in question, and connected up as follows: The generator cord and plug is connected to the source of the exchange ringing current, and the plug is inserted in the proper jack. The battery cord and plug is similarly connected, the current being obtained from the exchange battery. The operator's set is plugged into circuit, and the line terminals connected up by means of the plug and cord shown in Fig. 1. The line terminals are connected to the cable clips by means of snap connectors, and the balance relay is operated by throwing the (*Buz*) key. A peculiarly sounding interrupted current is transmitted over the tip and ring conductors of the test set to the cable conductors.

The cable man at the distant end searches for this pair of conductors with one side of his test set. When he makes connection with the pair, the relay in the rack test set ceases to operate as a buzzer and attracts its armature permanently, thus closing the lamp circuit and lighting the lamp, and giving notification that the pair has been found. The two men testing can then converse with each other.

Ordinarily when the lamp lights during tests, the operator in charge of the set places the talking set in service by means of the

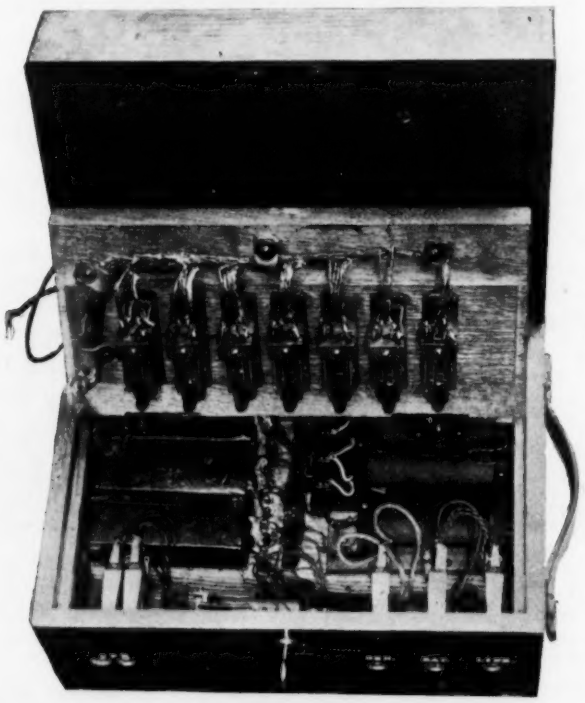


FIG. 2.—VIEW SHOWING INTERIOR ARRANGEMENT.

operator's key (*Oper*), thus extinguishing the lamp, after which conversation can be held over the conductors selected.

At times it is more desirable to test in another manner, and the man at the distant end of the cable connects his set to a certain pair of conductors while the operator at the exchange set locates this pair by running the test snaps along the cable terminals until this pair is found.

This later method is much quicker, but can be adopted to good advantage only under limited conditions. At such times as there is a large number of conductors to be tested in one cable, a pair of conductors can be utilized to talk over at all times, regardless of the condition of the remaining apparatus in the set. The talking plug and cord (*Talk*) in the diagram is provided for this purpose, and it will be seen that this is directly connected to the operator's set.

By arranging this set to a pair of conductors in conjunction with a talking set at the distant end the two men testing can talk at all times during the testing. Under this arrangement the test for the conductors is identical, except, of course, the manner of communication. This method is quick, insomuch as no time is lost in arranging the sets for talking.

It is possible to test out a live cable with this set without interference, but the lamp operation cannot then be obtained because it is necessary to operate through a condenser placed in the circuit by means of the battery cut-off key (*BC*), as shown in the diagram. The man at the distant end would also have to place a condenser in series with his set so as not to short-circuit or ground the circuits during the tests. In this method the switchboard sig-

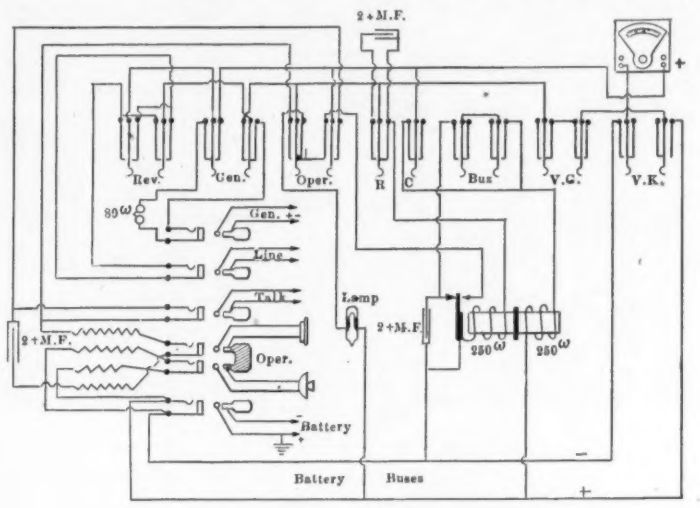


FIG. 3.—DIAGRAM OF CIRCUITS.

nals are not interfered with, but paths are provided for the ringing current in case an operator rang on a line under test, as this current readily passes through a condenser.

A faulty unused conductor would give notice of the defect by a relay operation during the buzz test, unless the trouble be due to an "open" conductor, in which case no test could be secured ordinarily.

When it is desirable to test a conductor by means of the voltmeter the voltmeter key (*VK*) is thrown over, thus giving a metallic circuit measurement by the series method. By operating the voltmeter ground key (*VG*) in conjunction with the voltmeter key (*VK*), a single conductor is tested to ground by the series method. Both conductors can be tested in this manner by using the above combination in addition to the reversing key (*Rev*). At times it is necessary to ring out over cable conductors in order to ascertain if any telephones are connected to them, and for this reason the ringing key (*Gen*) is provided.

A test set similar to the one herein described will be found convenient about common battery exchanges, particularly during the installation of cables, as has been fully demonstrated in actual practice.

Danger of Christmas Decorations.

Special attention has been called in a timely manner by the National Fire Protection Association to the hazard of Christmas decorations and displays. Mr. W. H. Merrill, Jr., secretary, has reissued the Philadelphia circular on the subject quoted below:

The executive committee of the Philadelphia Fire Underwriters' Association feels compelled to call the attention of the public to the dangers to life and property from Christmas displays, decorations, signs, etc., in churches, public buildings, mercantile establishments and especially department stores. The use of Christmas greens, harvest specimens and other inflammable materials, such as draperies, scenery, cotton to represent snow, and the like (especially in connection with electric and other lighting systems), is decidedly an increase of hazard, it being impossible to make displays of that nature perfectly safe. One of the conditions of the insurance policy is that:

"This entire policy, unless otherwise provided by agreement endorsed hereon or added thereto, shall be void if the hazard be increased by any means within the control or knowledge of the insured."

The making of such displays would, therefore, under a strict interpretation of the conditions of the policy render the contract of insurance void, unless the policy is endorsed with a special permission for the increased hazard, which will generally be granted only

in consideration of an additional premium commensurate with the hazard.

If electricity is used in the building the permit for same in the insurance policy is subject to the following conditions, viz:

"No additions, alternations or repairs shall be made in the system of wiring, lamps or any portion of the system of wires or appliances for conducting, creating or controlling the electric current until written notice has been given to the Philadelphia Fire Underwriters' Association and an additional permit granted for such."

Therefore, any such changes made in violation of the above condition will affect the insurance.

In addition to the danger to property from displays referred to, the danger to life in crowded stores or places of meeting by reason of a panic occasioned by a fire, even though it be small and easily controlled, is so great that the Underwriters, who have made a study of such hazards, would only be partly fulfilling their duty should they fail to give this warning.

The Proposed Washington Plant.

Bids were opened November 20 on the amended specifications for the power plant for the Capitol at Washington, as follows:

Westinghouse Electric & Mfg. Company, Pittsburg, Pa., proposition 2, $1,084,369; deduction, $596,002, leaving the bid $488,367; proposition 3, $901,736; deduction, $471,929, leaving the bid $429,807.

J. G. White & Co., New York, proposition 1, $1,189,250; deduction, $595,034, leaving bid $594,216; proposition 2, $1,059,299; deduction, $549,377, leaving bid $509,962.

Carl Leonard de Muralt, New York, proposition 1, reciprocating engines, $1,164,700; deduction, $395,500, leaving bid $769,200; proposition 2, turbines, $1,119,800; deduction, $372,500, leaving bid $747,300.

Lynch & Woodward, Boston, Mass., proposition 1, reciprocating engines, $862,726; deduction, $486,957, leaving bid $375,769.

Hanley-Casey Company, Chicago, Ill., proposition 1, $1,047,277.85; deduction, $548,495.65, Babcock & Wilcox boilers, leaving bid $498,782.20; proposition 2, $1,047,277.85; deduction, $556,495.65, leaving bid $490,782.20; proposition 3, $1,047,277.85; deduction, $583,495.65, Atlas boilers, leaving bid $463,782.20.

McIntosh & Seymour Company, New York, proposition 1, $903,730, horizontal compound engines; deduction, $481,054, leaving bid $422,676; proposition 2, $918,500, vertical engines; deduction, $488,052, leaving bid $430,448.

The Schofield Company, Philadelphia, Pa., proposition 1, $1,015,450; deduction, $453,647, leaving bid $561,803; proposition 2, $074,100; deduction, $423,844, leaving bid $550,256.

The original bids were given recently in these columns.

Cabinet Telephones.

A few years ago it was quite the thing among "independents" to boast of the ownership of an ornate tandem cabinet magneto telephone, and the longer the battery box and the more material used in its construction the greater was the pride of its owner. Then came the more practical wide battery box cabinet, so extensively used by the Bell Company interests, and which still has a strong hold upon the fancy of a goodly share of operators and subscribers. Later the compact style of cabinet made its appearance, the original design for which is claimed by half a dozen manufacturers, and is to-day by far more generally used in the independent field than all other styles combined.

This convenient, economical and practical style of telephone now finds a rival in the "Ideal" cabinet. It was originally designed and placed on the market by the Wesco Supply Company, of St. Louis, several years ago, but it proved to be a "snow flower" born before its time "to blush unseen" by but a very small portion of the trade. Since that time, however, several manufacturers have recognized the commercial value of this cabinet design and have made efforts to introduce it to the trade, with the result that a very general demand is springing up for this style of instrument.

The accompanying illustration shows the "Ideal" magneto telephone as now placed on the market by the Wesco Supply Company. Among its advantages are the facts that the line terminals are inside of the cabinet, entering from the rear of the backboard, thus placing these binding posts out of the reach of the user and avoiding the trouble so often experienced by patrons tampering with the line terminals.

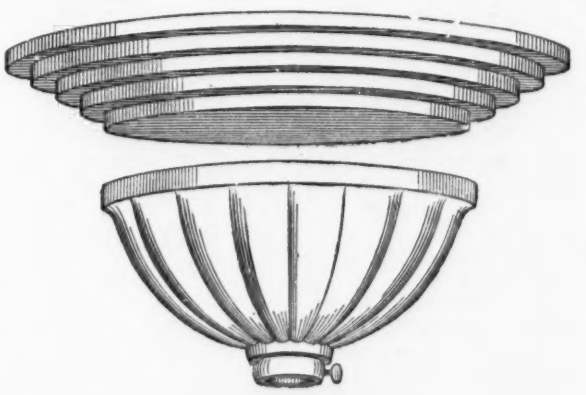
In this instrument all the wiring is done from the rear of the

FIGS. 1 AND 2.—CABINET TELEPHONES.

board and all the parts are firmly secured to the backboard, no shelves being used. Another point in its favor is that the transmitter arm is attached to the backboard, which gives it a solid base and avoids the tendency to vibration experienced in the compact style of instruments, where the cabinet itself acts in the manner of a sounding board to the transmitter.

Ceiling Fixture Block.

The fixture block illustrated herewith has been introduced by the H. C. Roberts Electric Supply Company, 905 Arch Street, Philadelphia, and bears the name of that concern. As will be seen from the engraving, it is made with steps so as to fit different sizes of standard canopies and will thus accommodate no fewer than four



CEILING FIXTURE BLOCK.

sizes, namely, those of 3, 3½, 4 and 4½ in. diameter. Having this ability to meet the necessities of four sizes, the Roberts block obviously takes the place of four sizes of the old-fashioned block. When a canopy has been put in position on this block it cannot "side slip," but is fixed firmly in the proper central position around the fixture stem. It is, moreover, neat in appearance and should appeal alike to the central station company, the isolated plant or the individual user. The prices are moderate whether for the plain unfinished type or for that in highly polished oak.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Jobbers and manufacturers are busily engaged on holiday goods, some lines of which are already reported oversold. In many wholesale lines, on the other hand, seasonable quiet prevails. Manufacturing plants make very satisfactory returns, despite the high level of prices for raw materials and inadequate transporting facilities. Taken as a whole, the reports as to the traffic situation show a small improvement. Railway earnings thus far available for November were 6.5 per cent larger than a year ago and foreign commerce at the port of New York for the week shows gains of $4,286,535 in exports and $2,874,907 in imports, as compared with last year's figures. Reports from the various industries are still highly favorable, iron and steel leading with unprecedented demand and consumption for this season, the highest prices of the year being freely paid, and premiums are eagerly offered for prompt deliveries of finished products. The labor situation is rather more restless, notably in the New York building and shipping trades. Prices of speculative staples all show great strength. Spot cotton sold at 12c., which is the highest price of the year. The cotton goods market was very strong and active in nearly all departments. In the metal market, copper is selling at the highest price in six years. Sensational advances were made, the net gain being about 9/16c. This represents a rise of 2c. in about two months. It is considered in some quarters that this advance has not been justified by commercial conditions and that it has been due largely to manipulation by producers. The closing quotations were 17⅞c. for Lake and electrolytic and 17⅝c. for casting stock. There is great activity in the coal trade, the output and shipments being limited only by car capacity. Commercial failures during the month of November numbered 817, with liabilities of $8,866,798, which compares with 864 in the corresponding month last year, when defaulted indebtedness aggregated $8,535,459. Manufacturing insolvencies were 197 in number and $4,317,443 in amount, against 217 for $3,540,983 in November, 1904. In trading occupations there were 591 defaults involving $4,256,184 compared with 618 failures and $3,929,143 liabilities. In banking and other fiduciary undertakings there were 4 suspensions, with liabilities of $111,200, comparing most favorably with 9 defaults for $761,724 last year. Increased losses in the two chief classes are largely due to the abnormally small failures last year, which were lighter than in any recent November. *Bradstreet's* reports 188 business failures during the week ending November 30, against 224 the week previous and 184 in the corresponding week last year.

BOWRING & CO., 17 State Street, New York, recognizing the opportunities for trade in the Far East, sent Mr. E. R. Duer, the head of their export and import commission department, to the Orient to make investigations and establish business connections in that field. Mr. Duer was in Japan before the war closed and was able to put himself in very close touch with the leading individuals and firms carrying on business in that country. After a thorough investigation he arranged with Messrs. Cornes & Co., one of the oldest English houses in Japan, having establishments in both Yokohama and Kobe, to act as Japanese representatives, Bowring & Co., at the same time, caring for their interests in this market. The business of Messrs. Cornes & Co., covers a widely diversified field. They have an office in London, and are the Japanese correspondents of such firms as J. P. Morgan & Co., Lloyds of London, the Lancashire Insurance Co., the Drexels of Philadelphia, etc. They are in touch with the highest officials of the Japanese Government. Messrs. Cornes & Co. also maintain fully equipped engineering and electrical departments, both of which are under the supervision of competent engineers. Since making the arrangements above referred to Bowring & Co. have succeeded in obtaining several agencies for them from prominent American manufacturers, and now have specifications in hand and prices on various machinery and appliances required for the remodeling of the Imperial Japanese Naval Arsenals. According to the latest advices, Mr. Duer was last in China. After covering that field he will visit the Philippines and possibly Australia, where Bowring & Co. are represented by Robert Little & Co., of Sydney. The firm have also an agency in Buenos Aires, Argentine Republic.

BROKEN STEEL RAIL.—In a decision by I. F. Fischer, the Board of United States General Appraisers have sustained a claim filed by P. McGettrick, of Burlington, Vt., against the action of the Collector of Customs in levying a heavy duty on pieces of old street railway steel girder rails. It appears from the testimony laid before the board that the rails had been laid down and used in the streets of Canadian cities; that they were welded together end to end, and that after being torn up they were broken into pieces of irregular lengths. They were broken in the middle section of the rails and not at the welds, the majority of the pieces being from three to ten feet long. Another point brought out was that in many instances the "lip" of the rail was broken, thereby rendering it absolutely unserviceable for use. The collector demanded the full duty applicable to T rails at the rate of seven-twentieths of 1 cent per pound, whereas the importer maintained that the merchandise should properly be assessed as scrap steel at the rate of $4 per ton. The importer's claim was upheld, and the collector instructed to return the overcharge.

SOUTHERN LUMBER.—The Frost Cross Arm & Lumber Mfg. Co., Inc., of Cleveland, O., has purchased over 12,000 acres of long leaf yellow pine lumber land, near Ocala, Fla., on the Atlantic Coast Line Railroad, and is now erecting a new and modern mill which will have over five times the capacity of its present plant at Chesterfield, S. C. This new plant will be divided into three departments, viz., rough lumber, dressed and kiln-dried lumber, such as dimension stock, car sills, etc.; and the cross arm factory. The concern will deal only in long leaf, all heart yellow pine cross arms, of the highest grade only, and expects to be in a position to accept orders soon after the first of the year, when its present plants will have been disposed of. It will have one southern office, viz., that in Florida, and will move its general offices, north, from Cleveland to some point near Philadelphia. It will also in all probability change the name of the concern to the Lake Yale Lumber Co., as the timber is on that lake; but the management of the company will remain exactly the same as at present, under Mr. A. S. Ward, president and general manager.

THE OSWEGO BOILER WORKS at Oswego, N. Y., have been purchased by New York parties understood to be associated with the A. D. Granger Co., the machinery house at 95 Liberty St., New York, with branches at Philadelphia and Pittsburg. The plant, which occupies about twenty acres on the lake front, was established some twelve years ago, and will be placed in active operation at once. Steel plate work in all branches, including boilers, tanks, and stacks, will be manufactured. The new company will be known as the Oswego Boiler & Engine Co., with the main office at Oswego, N. Y.

THE LINDSLEY-BAUMAN COMPANY has recently been formed as the successor to the Lindsley Brothers Company. It has offices at Menominee, Mich., and Alfred, Mich., and in the Tribune Bldg., Chicago. H. A. Bauman is the president, G. L. Lindsley, vice-president, and E. A. Lindsley, secretary and treasurer. The capital stock has been increased to $50,000, and the company will carry at all times a complete stock of poles, posts and ties, as was done by its predecessor.

WESTINGHOUSE TURBINES FOR LOS ANGELES.—The Edison Electric Company has closed contracts for a 7,500-kw Westinghouse-Parsons turbo-generator, including condensing plant for its new No. 3 station. The overload capacity will be over 30 per cent, making this one of the largest steam-turbine generating sets ever built. The generator is to be three-phase, 16,500 volts, 50 cycles. The present equipment of the Los Angeles No. 3 power house consists of two 2,000-kw Curtis steam turbines.

JAPANESE PROGRESSIVENESS.—The Calculagraph Co. is distributing with proper pride examples of the time checks employed by the Japanese Porcelain Co., of Noritaka, Japan, in its factory there, as records for its workmen. We doubt whether any American, French or English porcelain factory has yet reached the point of using calculagraphs to record the hours of work, like the brainy, progressive Japs.

DEMAND FOR COPPER.—It is stated that the General Electric Co. will consume between 55,000,000 and 60,000,000 pounds of copper this year, as compared with about 40,000,000 in the preceding year. This will be the largest amount of copper ever consumed by the corporation in one year.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, Rochester, N. Y., reports having closed contracts for switchboards for the following places: Robinson, Ill.; Lakewood, Ill.; Holt, Mo.; Houlton, Me.; Bingham, Utah, and Harrisonville, Mo.

STEAM TURBINES AS RESERVE POWER.—The Missouri River Power Transmission Company, operating in the vicinity of Helena, Mont., and notable as owning one of the highest voltage transmissions in the world, has begun the erection of a steam turbine power plant to operate as a reserve to its present water power plant. A large part of the output of the Missouri River system is transmitted to the city of Butte, and the Anaconda district mining properties, and the service has grown to such an extent as to warrant the erection of a reserve plant as a protection against serious fluctuations in the available water power. Turbines of the Westinghouse-Parsons type will be installed, the initial equipment, consisting of two units of 2000 kw. capacity each, operating at 1200 r.p.m., with 150 pounds pressure, 28 in. vacuum, 100 degrees superheat. They will be capable of delivering continuous overload of at least 50 per cent condensing, or full load without the assistance of a condenser. The generators will be of the revolving field type, and completely enclosed, with forced ventilation. This feature will entirely eliminate the peculiar hum of the high speed turbine generator of the open type. The generators will operate at 1,200 r.p.m. and deliver 60 cycle, 3-phase current at 2400 volts. The motor-generator exciter and complete switchboard equipment accompanies the turbine plant. The Westinghouse Machine Company, builders of the turbines, will also equip the boiler plant with their mechanical stokers.

AMERICAN ARC LAMP CO.—A whole page is devoted by the Kalamazoo, Mich., *Gazette* to the announcement of the fact that the American Arc Lamp Co. has located there and has a handsome new factory in which to continue the production of its Lea lamp. This enclosed arc is already well known to the industry and has been illustrated and described in these pages. The new factory is a two-story building of brick, well equipped and admirably situated in the heart of the manufacturing district. One of the men identified with the Messrs. Dewings in the concern is Mr. Walter Ramsey, formerly of Indianapolis. He is a man of wide experience and excellent business training and has had charge of the business for several years. Under his management the concern and the lamp have taken a place as leaders among enclosed arc lamps on the market. He expects to become a permanent resident of Kalamazoo and is delighted with his new surroundings. Mr. Charles M. Rose, superintendent of the factory, served ten years with the company, beginning with Mr. Lea. He is well fitted for the position he holds, being a thoroughly practical electrician and familiar with every detail of the manufacture of the lamps. During his service with Mr. Lea, he was of great assistance to the inventor and many of his ideas are embodied in the improved Lea lamp now being vigorously pushed.

WESTINGHOUSE ACTIVITY.—One hears no talk of dull times among the workers in Turtle Creek Valley, locally known as "Westinghouse Valley," owing to the territory being practically covered by the various Westinghouse factories, which extend from East Pittsburg to Wilmerding and Trafford City on the main line of the Pennsylvania Railroad. The largest of these is the Westinghouse Electric & Manufacturing Company, covering over 47 acres at East Pittsburg, where everything electrical is manufactured. Some idea of the magnitude of the business handled at this plant can be formed when it is stated that during the month of October the shipment of electrical apparatus from this factory, exclusive of a large number of local freight and express orders, amounted to approximately 17,000,000 lbs., consisting of over 5,000 individual consignments. Among the more interesting recent shipments was one to the Hawaiian Electric Company, Honolulu, consisting of a 1,200 kw. alternating current generator, and three 500 kw. oil transformers with the necessary auxiliary apparatus. This material is intended for their power station on Kauia Island, the most northern of the Hawaiian group. The shipment goes direct from New York on the S. S. Arizonian, and is the second of a series of similar shipments, the first having gone forward some thirty days ago.

CROPS AND PROSPERITY.—The annual report for 1905 of James Wilson, Secretary of Agriculture, says: "Farm crops have never been harvested at such a high general level of production and value. Corn has reached its highest production, over 2,700,000,000 bushels, of a total estimated value of $1,216,000,000. Hay comes second. with a value of $605,000,000. Cotton is expected to yield $575,000,000. The short wheat crop of last year is followed by one of 684,000,000 bushels, and its value, $525,000,000, overtops the highest value ever before reached. While only one crop, corn, reached its highest production this year, four crops—corn, hay, wheat and rice—reached their highest value. The wealth production on farms in 1905 has reached the highest amount ever attained by the farmer of this or any other country, 'a stupendous aggregate of results of brain and muscle and machine,' amounting in value to $6,415,000,000, an excess over last year of $256,000,000. The wealth produced on farms in 1906 exceed that of 1904 by 4 per cent, that of 1903 by 8 per cent, and that shown by the census figures for 1899 by 36 per cent."

PRICE OF COPPER.—Mr. John Stanton, the copper expert, says: "I have been offered as high as 18 cents a pound for high grade copper, but have not been able to make any contracts at this figure for the reason that I have no copper to sell. Of course we do not expect copper to remain around 18 cents for all time to come. It will eventually decline, but before there is any decline it is likely to go up to 20 cents. I am not in favor of a further sharp upward movement, but when consumers offer fancy figures those who have the copper are likely to satisfy these demands. No heavy sales of copper are being made at the prices now prevailing, one of the reasons being that the big consumers have covered their wants for sometime ahead, and producers are busy fulfilling these contracts. Developments indicate that the market is not "rigged." The prices are very tempting to sellers, but they haven't got the copper to sell. Exports will be very small this month, perhaps 15,000 tons, notwithstanding the copper abroad is very scarce. Home consumption is responsible for the falling off in exports."

ENORMOUS ORDERS FOR CARS.—The New York Central Railroad has placed orders with several manufacturing companies for a total of 25,000 freight cars, calling for the expenditure of about $25,000,000. The order exceeds that placed recently by the Pennsylvania Railroad for 21,000 cars, which until a few days ago was the largest order for equipment ever placed by a railroad in this country. The tremendous scale on which the railroads are now providing equipment indicates the pressure under which they are working to care for the traffic that is being offered to them. The orders placed by the Central are for delivery all through the year 1906. The head of one of the companies which are to manufacture the cars said, however, that it was doubtful if the whole number could be turned out on time, owing to the great demands being made upon the equipment companies. This, however, in view of the electrical requirements, etc., does not represent the full extent of the New York Central car requirements.

TELEFUNKEN WIRELESS.—Ostheimer Bros., of the Burd Building, Philadelphia, writes as follows: "We hereby beg to inform you that the Wireless Telegraphy Company, Limited, Telefunken system, will, on and after December 1, 1905, be represented in the United States by the Telefunken Wireless Telegraph Company of the United States. The entire business heretofore transacted by Messrs. Ostheimer Brothers, as United States agents of the abovementioned company, will be taken over by the Telefunken Company of the United States, which corporation now assumes all the liabilities and contracts entered into by Messrs. Ostheimer Brothers as agents of the aforesaid system."

WASHINGTON, D. C.—Bids will be received until Dec. 12 at the Bureau of Supplies and Accounts, Navy Department, Washington, to furnish at the navy yards at Portsmouth, N. H.; Boston, Mass.; New York, N. Y.; League Island, Pa.; Washington, D. C., and Norfolk, Va., electrical wire and supplies, poles, generating sets, etc; also on Dec. 26 to furnish at the navy yards at Mare Island, Cal., and Puget Sound, Wash., searchlights, etc. H. T. B. Harris, Paymaster-General, U. S. N.

J. G. WHITE & CO.—A steam railroad running from MacKey's Ferry to Beaufort, N. C., will be built for the Virginia and Carolina Coast Railway Co. This road will extend a total length of approximately 120 miles. The contract has been awarded to J. G. White & Co., 43 Exchange Place, New York, who will do all the clearing, grading and track laying work, as well as the building of steel bridges and viaducts.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market was subjected to manipulation on a large scale, the prominent feature being the southern iron stocks, although Union Pacific and other standard railroad shares also received similar attention. Toward the close of the week the trading developed weakness, due to a renewed hardening of call loans. While iron and steel stocks, including the United States Steel shares showed strength, they were subordinated entirely to the demonstration in the southern group. Some of the other industrials were very strong. Amalgamated Copper was another strong feature at times, but, on the other hand, the traction shares were less prominent; and the manipulation of Brooklyn Rapid Transit has temporarily subsided. There was active trading in the latter stock, 213,550 shares having been sold at prices ranging between 85½ and 89⅜, the former figure being also the closing quotation. The net result for the week is a decline of 2½ points. Metropolitan Street Railway closed at 118¾, which is a net loss of 1¼ points, and Interborough Rapid Transit closed at 210. Allis-Chalmers common is down ½ point, the closing quotation being 19½; preferred closed at 62. General Electric was on the downward turn and closed at 184, a net loss of 4 points. Westinghouse common and preferred closed at 174⅛ and 190, respectively, the former

being a net gain of ⅛ point. American Locomotive common is 1¾ points higher, closing at 71; preferred closed at 117. Western Union declined ⅝ and Mackay Companies gained 1 point, the closing prices being 92⅛ and 52¼, respectively. The curb market was irregular, with early firmness, followed by easing off in most stocks in sympathy with the Stock Exchange list. The volume of business was smaller. The closing quotations on the Stock Exchange Dec. 5 were as follows:

NEW YORK

	Nov. 28	Dec. 5		Nov. 28	Dec. 5
Allis-Chalmers Co.	20⅜	22¼	General Electric	186	185½
Allis-Chalmers Co. pfd.	62	64	Hudson River Tel.	..	..
American Dist. Tel.	37	37	Interborough Rap. Tran.	210¼	211
American Locomotive	71	72⅝	Mackay Cos.	52⅜	50⅛
American Locomotive pfd.	118¼	118	Mackay Cos. pfd.	72¾	71
American Tel. & Cable	91	90	Marconi Tel.	..	..
American Tel. & Tel.	136	132	Metropolitan St. Ry.	120¼	117⅝
Brooklyn Rapid Transit	87¾	85	N. Y. & N. J. Tel.	..	..
Electric Boat	32	32	Western Union Tel.	92⅝	92⅛
Electric Boat pfd.	70	70	Westinghouse com.	170	170
Electric Vehicle	14	14	Westinghouse pfd.	..	..
Electric Vehicle pfd.	20	20			

BOSTON

	Nov. 21	Dec 5		Nov. 28	Dec. 5
American Tel. & Tel	136	132⅛	Mass. Elec. Ry. pfd.	59½	59⅛
Cumberland Telephone	121¼	...	Mexican Telephone	1⅜	1⅜
Edison Elec. Illum.	...	...	New England Telephone	..	..
General Electric	...	...	Western Tel. & Tel.	13	12
Mass. Elec. Ry.	14¼	...	Western Tel. & Tel. pfd.	..	..

PHILADELPHIA

	Nov. 28	Dec. 5		Nov. 28	Dec. 5
American Railways	53	52	Phila. Electric	8⅛	8⅜
Elec. Co. of America	11⅛	11¼	Phila. Rapid Trans.	32⅛	31¾
Elec. Storage Battery	80	80⅜	Phila. Traction	..	..
Elec. Storage Battery pfd.	..	..			

CHICAGO

	Nov. 28	Dec. 5		Nov. 28	Dec. 5
Chicago City Ry.	200	200	National Carbon	75	76½
Chicago Edison	162	161	National Carbon pfd.	114⅛	*120
Chicago Subway	49¼	53	Union Traction	..	..
Chicago Tel. Co	..	137	Union Traction pfd.	..	..
Metropolitan Elev. com.	27¼	27			

* Asked.

BELL TELEPHONE BONDS.—President Fish, of the American Telephone Company, says that while no plans have been made for issuing further securities of the American Telephone & Telegraph Company, and the company is now seeking only to place itself in a position to issue any form of security that may be most advantageous, the officials of the company believe that there might be great advantage in the issue of convertible bonds to the extent of $150,000,000 to be used from time to time. This form of security is attractive to investors for obvious reasons, and would be likely to be readily taken in a broader market than that to which the present issues of Telephone securities have been to some extent confined. There would be no difficulty in securing the capital required for the development of the business in other way, but at the present time a convertible bond seems to be generally regarded as the form of security that can be issued to the best advantage of the company and with the greatest satisfaction to investors.

SAN FRANCISCO UNITED.—Brown Brothers & Company have disposed of all their interest in the United Railways Investment Company of San Francisco, and Ladenburg, Thalmann & Company with their associates and clients now hold a controlling interest in the property. With the change of control Arthur Hollins, who has been president of the company, has resigned, and his successor will be named by the new controlling interests. The United Railways Investment Company controls the street railway system of San Francisco. The company is capitalized at $25,000,000, divided into $10,000,000 common and $15,000,000 preferred stock. Brown Brothers & Company were the managers of the underwriting syndicate which organized the present company. The earnings of the property have increased steadily from the time of the settlement of the strike of the employes, which came soon after the organization of the new holding company. The preferred is now paying 4 per cent. This dividend, it is said, will soon be increased to 5 per cent, which is the full rate to which the stock is entitled.

LONG ISLAND TROLLEYS.—The Belmont syndicate and the Long Island Railroad Company have jointly become owners of the trolley line which runs from Queens, L. I., through Jamaica to Far Rockaway. The property was purchased to extend the street electric system in Queens and Nassau counties controlled by the two interests. The recent purchase has about fifteen miles of track and is said to be a profitable line. It owns valuable franchises besides its own power house and electrical equipment. The Belmont syndicate and the Long Island Railroad have a franchise for a trolley line on the Jericho Turnpike, and it is reported that they are getting ready to build the road. They own all the trolley lines in Nassau County. The Belmont syndicate owns the New York & Queens County Railway Company, which owns all the trolley roads in Queens, with the exception of two branches of the Brooklyn Rapid Transit Company.

U. S. TELEPHONE DEAL.—Stockholders of the Rochester Telephone Company have received circulars from the United States Independent Telephone Company, of which Thomas W. Finucane is the president, withdrawing in effect the former offer to take over the stock of the Rochester company for cash. While the circular does not make explicit mention of any withdrawal, it releases the Rochester company stockholders from existing option agreements, but allows them to exchange Rochester telephone stock for United States Independent stock if they so desire, thus putting all compensation in stock instead of in cash. The United States Company also announces that it has filed its $25,000,000 property mortgage to secure bonds. This is done although the local company has not yet been taken over.

NORTHERN NEW YORK TRACTION.—The new company which is to take over the trolley system of the United Traction Co., of Albany, in the interests of the Delaware & Hudson will probably be known as the Northern New York Traction Co. So far, 94 per cent of the stock of the United Traction Co. has been deposited with the National Commercial Bank of Albany under the terms of the purchase. The preferred stock and debentures of the new company, both of which are guaranteed by the Delaware & Hudson, are offered to the public, while the Delaware & Hudson will hold the common stock. The preferred stock, which is entitled to a dividend of 4 per cent, is offered at 104½, and the 3¾ per cent debentures at 97½.

STANISLAUS POWER.—Messrs. Tucker, Anthony & Co. of Boston, in conjunction with F. L. Eldridge of the Knickerbocker Trust Co., N. Y., and C. C. Cuyler of Cuyler, Morgan & Co., N. Y., have successfully placed the underwriting of $5,500,000 of 5 per cent bonds and $2,750,000 of preferred stock of the Stanislaus Electric Power Co., organized under the laws of California for the purpose of developing water power in the Middle Fork of the Stanislaus River in California. It is planned to develop 25,000 electrical horse-power and in addition thereto water power equivalent to 16,000 horse-power.

KEYSTONE TELEPHONE.—The Keystone Telephone Company, of Philadelphia, has earned about $657,000 gross in the ten months ended Oct. 31, 1905, and $256,000 net applicable to bond interest, after deducting renewal reserve in addition to the ordinary operating expenses. The interest charges on the entire bonded debt for a full year are only $200,000 or 5 per cent on $4,000,000 bonds. November and December should add at least $15,000 to the net applicable to fixed charges, which would give a surplus of $75,000 for the twelve months of 1905, over a full year's interest on the new bonds.

REPORT OF WORCESTER ELEC. LIGHT CO.—The Worcester Electric Light Co., Worcester, Mass., has filed with the State Board of Gas and Electric Light Commissioners its annual report for the current fiscal year, showing total assets of $1,081,049.75, of which $601,663.51 is for electric lines, $110,559.19 for electric plant, and $97,007.97 for real estate, with total liabilities amounting to $786,335.90, of which $600,000 is for capital stock. The profit and loss balance is $294,713.85 on its capitalization.

GENERAL ELECTRIC STOCK.—At Schenectady on December 5, a special meeting of the stockholders was held at the company's office at 2 o'clock p. m., for the purpose of voting upon a proposition to increase the capital stock of the company by the amount of $11,674,500, consisting of 116,745 shares of the par value of $100 each, so that the capital stock shall be increased from the present amount, viz: $48,325,500, consisting of 483,255 shares of the par value of $100 each, to $60,000,000, consisting of 600,000 shares, of the par value of $100 each. The increase was duly voted.

SOUTHERN BELL INCREASE OF CAPITAL.—A special meeting of the stockholders of the Southern Bell Telephone & Telegraph Company has been called for December 13, to vote on a proposition to increase the capital stock of the company from $1,000,000 to $30,000,000.

NEW YORK CONNECTING R. R.—Terms for the franchise for the New York Connecting Railroad as fixed by Comptroller Grout are $250,000 cash in advance, $50,000 per annum for the first ten years, and $100,000 per annum for the next fifteen years for every 25-year contract.

DIVIDENDS.—The Ashton Valve Co. has declared an extra dividend of 1 per cent, payable Dec. 15, 1905. Directors of General Electric Co. have declared the regular quarterly dividend of 2 per cent, payable January 15.

PHILADELPHIA TRANSIT COAL.—The Philadelphia Rapid Transit Company has built a 65,000-ton storage plant for coal, and has ordered the Reading Coal & Iron Company to fill it at a cost of $168,750.

General News of the Week

The Telephone.

PINE BLUFFS, ARK.—The City Council has granted a franchise to the Southwestern Telephone & Telegraph Company to place its wires underground in the business section of the city.

HOLLISTER, CAL.—George Burg has been granted a franchise to build a telephone line from Panoche to New Idria.

SAN FRANCISCO, CAL.—Dr. Hugh Cumming, Federal quarantine officer at this port, has called for bids for laying a telephone cable from the city to the Angel Island station. An independent telephone system will be installed, connecting the station with the city lines of the Pacific States Telephone & Telegraph Company.

SAN FRANCISCO, CAL.—The Home Telephone Company, of San Francisco, is showing much activity, now that the municipal election is over and it is hoped that the present Board of Supervisors will pass an ordinance advertising the telephone franchise for sale. The company is willing to take the chances on the new Board's harmonious action next year. Under the ordinary course of procedure in advertising and selling a franchise it would take until about the middle of May next to comply with the legal requirements, including the 90 days' advertising. So, unless the Supervisors expedite matters by waiving preliminaries and advertising a franchise promptly, work will not be commenced on the new system much before June 1, 1906. F. F. Graves, of Los Angeles, is in San Francisco. Favorable progress is reported by the Home Telephone Company of Alameda County, in Oakland, Cal., where a franchise sale has been authorized. The United Long Distance Telephone Company, which operates interurban telephone lines connecting with the exchanges of the several "Home" companies, now connects with 115 towns in California south of Santa Barbara. Business has been opened in twelve new towns between Santa Ana and Los Angeles, as follows: El Toro, Myford, Capistrano, Oceanside, Encimitas, Del Mar, San Diego, El Cajon, Coronado, Pacific Beach, La Jolla and National City. The San Diego Home Telephone & Telegraph Company has secured an exclusive right to build telephone lines for a distance of 160 miles into Mexico from the American boundary.

DOVER, DEL.—The Central Home Telephone Company, with a capital stock of $5,000,000, has been granted a certificate of incorporation. The new company will conduct extensive operations, especially in the Middle West, both in constructing new lines and consolidating existing local lines. The incorporators are Edward L. Barber, Wauseon, O.; John C. Monteith, Louisville, Ky.; John C. Monteith, Bloomington, Ind., and James E. Bergen, Nanticoke, Pa.

McLEANSBORO, ILL.—The new telephone line from Springterton to McLeansboro is completed.

MT. CARROLL, ILL.—The Mt. Carroll Mutual Telephone Company has been formed. Capital, $5,000.

PEORIA, ILL.—A new cable is being laid across the river at the foot of Bridge street. It is being placed by the Central Union Telegraph Company.

AUBURN, IND.—The Bell Telephone Company has finished rebuilding the exchange in this city, at a cost of $50,000.

GOSHEN, IND.—The new switchboard at the central office of the Home Telephone Company is in operation. An addition to the board will be necessary in the near future.

WALDRON, IND.—The Moore Telephone Company has been organized. Arrangements have been made with the Central Union Telephone Company for toll line service. Elmer E. Moore is president.

MARION, IND.—C. L. Barger is heading a telephone company which proposes to use automatic telephones and has applied to the City Council for a franchise to operate in this city. It is thought the franchise will be granted.

INDIANAPOLIS, IND.—The Board of Public Works and the Indianapolis Telephone Company have agreed upon plans for putting the company's wires underground throughout the park and boulevard territory on the north side.

SOUTH BEND, IND.—The St. Joseph Valley Telephone Company has incorporated to build independent exchanges and local lines throughout Northern Indiana. Theodore Thorward, president of the South Bend Home Telephone Company, is president of new company.

RUSHVILLE, IND.—At a metting of the independent telephone men of the eighth telephone district, held in Rushville, a resolution was passed pledging all independent telephone companies of the district to refrain from any further service connection with any company that has a connection, direct or indirect, with any sublicensee of the Bell company.

INDIANAPOLIS, IND.—The first meeting of the executive committee of the Indiana Independent Telephone Association was held in Indianapolis on November 23. Mr. G. W. Beese, of the committee, said the Indiana Association was carrying out every purpose for which it was organized and had done much to encourage development and stimulate the growth of the telephone business in Indiana.

WINCHESTER, IND.—The Eastern Indiana Telephone Company, with headquarters in this city, has filed articles of incorporation with the Secretary of State. The capital stock is $150,000. The directors are B. S. Hunt, J. S. Engle, A. L. Nichols, J. A. Browne, J. M. Fletcher and Robert Letschert. The first act of the stockholders and directors was to absorb the Parker City plant with full lines to Albany and Losantville. It is now believed this is a part of the policy of the Indiana Independents to organize strong companies in different parts of the State to absorb and merge a large number of small companies and save them from falling into the hands of the Bell Company.

PRESTON, IA.—A new telephone line is being built between Preston and Miles.

WATKINS, IA.—The North St. Clair Township Company has begun to build a new telephone line.

COLUMBUS JUNCTION, IA.—The Muskatine-Louisa County Telephone Company will establish an exchange here.

OTTUMWA, IA.—The Hamilton County Telephone Company now has a toll line direct to Boone and with connections from there on direct to Des Moines and intermediate points.

MANCHESTER, IA.—The Bell Telephone Company has been at work in this city erecting new 39-foot poles with 3 cross arms and 10 pins, between here and Delaware. This additional 30-wire service means more accommodations between towns and farmers.

BOSTON, MASS.—The New England Telephone & Telegraph Company has discontinued the bankers' private line which connected the banking and brokerage offices in the State Street district. This bankers' private line was inaugurated several years ago, but telephones were connected with it for firms not members of the New York Stock Exchange, and the New York Stock Exchange has recently ordered all its Boston members to discontinue this wire connection. This edict so reduced the number of subscribers for the service that the line was discontinued.

ATLANTIC CITY, N. J.—The National Grange Patrons of Husbandry at its recent meeting here unanimously favored a proposal to have the farmers organize independent telephone companies in their various localities as a means of securing more reasonable rates and better service through competition.

NIOBE, N. Y.—The Niobe Telephone Company has been formed with a capital of $1,000. Incorporators: L. L. Warner, L. C. Way and others, all of this city.

MIDDLE BASS, OHIO.—A telephone line is to be strung from this place to North Bass by the new Ottawa County Telephone Company during the winter months.

JEFFERSON, OHIO.—The inability of the Jefferson and Warren Company and the new Lyme Company to come to terms may result in another company being organized.

CHARDON, OHIO.—The Geauga County Telephone Company, of Chardon, has been incorporated with a capital stock of $10,000 by R. C. Carter, W. R. Nutt, H. S. Brown, James Niven and J. T. Daniels.

MARIETTA, OHIO.—The Washington & Monroe Telephone Company, of Marietta, has been incorporated with a capital stock of $5,000 by E. D. Amos, William Kette, Cyrus McHugh, W. J. Moore, C. A. Amos, B. C. Cline and J. O. Swallow.

LOWELL, OHIO.—Contracts have been signed between the Lowell Farmers' Telephone Exchange Company, of Lowell, O., and the Central District and Printing Telegraph Company, by which the independent company adopts the Bell instruments and connections and will interchange business with the Bell company.

COLUMBUS, OHIO.—A syndicate composed of Toledo and Columbus men has purchased the majority of stock in the Gallipolis Telephone Company and steps will be taken at once to improve and extend the system. The new owners will build exchanges in Pomeroy and Middleport and a long-distance line will be constructed to Athens, which will give the company good service to Columbus. Those who have purchased the controlling interest are Cyrus Huling, Columbus; Dwight Sapp and Frank Beam, Mt. Vernon; W. E. Morrison and J. E. Gardner, Toledo, and E. N. Coen, Vermillion.

GUTHRIE, OKLA.—The case of Oklahoma City vs. the Pioneer Telephone & Telegraph Company has been appealed to the Supreme Court. The plaintiff is seeking an injunction to prevent the company from increasing its rates. The injunction was granted by the probate judge of Oklahoma City, but when the appeal was taken to the district court the injunction was reversed.

JENKINTOWN, PA.—John R. Wiggins & Co. will take estimates upon plans for a new exchange at Jenkintown for the Bell Telephone Company.

WASHINGTON, PA.—The Greene County Telephone Company, an independent concern, will, by the purchase of the Carmichaels Telephone Company, enter the Greene County field, and begin active competition with the Bell and other interests. The Carmichaels company had franchises on the principal streets of Waynesburg and lines will be built into the Greene County capital at once. By working arrangements with other lines, the new concern will be able to reach Uniontown, Greeling, Pittsburg, Allegheny, Johnstown, Harrisburg, Philadelphia and Baltimore. It is stated that Mr. J. G. Splane, president of the Pittsburg & Allegheny Telephone Company, is interested in the new concern.

DREWRYVILLE, VA.—The Courtland Emporia Telephone Company, of Drewryville, has been incorporated by D. B. Drewry, president; F. P. Pope, secretary and treasurer, of Drewryville. The capital stock is, maximum, $5,000; minimum, $1,000.

MARSHFIELD, WIS.—The Badger State Telephone Company, in which Hon. J. C. Marsh of this city is interested, has completed a new metallic line which gives independent connections from Marshfield direct to Merrillan. This is an important connection, as it gives the local exchange excellent facilities for reaching the Central Wisconsin line comprising a number of towns not heretofore reached direct. By next summer a metallic line will reach La Crosse and complete the network.

Electric Light and Power.

OZARK, ARK.—R. H. Adams has petitioned for a franchise to establish an electric plant.

REDDING, CAL.—The Board of Supervisors has granted a franchise to the Shasta Power Company.

RED BLUFF, CAL.—The Calofirnia Gas & Electric Corporation, acting through its engineer, James H. Wise, has filed two notices of appropriation of water from Mill Creek, covering about 18,000 inches of water, ostensibly for the purpose of erecting an electric power plant. The location is about six miles from Morgan's Springs, and has been already located by the Tehama Transportation Company, composed of local and San Francisco capitalists, who have already done considerable work, building roads and surveying ditches. It is stated that the Tehama Transportation Company's rights have lapsed, as it has not done the amount of work required by law. This power site is considered by experts to be one of the best in Northern California, and, with the building of the electric railway from Chico to this point and the proposed electric railway from Red Bluff to Redding, this particular location is a very valuable one.

SANTA CRUZ, CAL.—The Santa Cruz Electric Light and Power Company has been sold by James McNeil, of this city, to John Martin and L. P. Lowe, of the California Gas & Electric Corporation. Messrs. Martin and Lowe are large stockholders in the Bay Counties Power Company of Oakland. The latter company has a contract to furnish power for the Santa Cruz Portland Cement Company, which is building an immense plant at Davenports, 14 miles up the coast. It is believed to be the intention of the new owners of the local company to extend the power line from Davenports to this city and use that power instead of its present supply.

SAN FRANCISCO, CAL.—The California Gas & Electric Corporation is rushing work on the new power house at Walbridge and Schwerin Streets, for it is to begin early in the new year supplying the United Railroads Company with electric power. The contract becomes effective next February, and is to run for twenty years. The new power house will contain three of the largest gas engines in the world, driving 400-kw alternators. About $1,000,000 is being spent on the new power house and its equipment. President Holland and General Manager Chapman, of the United Railroads Company, count on a large annual saving when the company does not have to supply its own electric power. The shops are to be equipped with the most modern facilities for repair work, and it is expected that many economies not possible under the present system, where the repair work-shops are scattered throughout the city, will be realized.

SAN FRANCISCO, CAL.—The California Gas & Electric Corporation has been receiving bids for three additional 5,500-kw, 3-phase, 60-cycle generators, and three direct-connected water wheels which are to be installed at various power plants on its system of transmission lines. Two new pipe lines and one power canal are to be constructed in connection with these improvements. While the company has experienced considerable inconvenience at some points on its lines from the long dry season, the shortage did not reach 50 per cent at any time, and it is now reported that nearly all of the plants are running on the normal flow of water without further depleting the storage reservoirs. After a period of 192 days without measurable rainfall in Northern California the drouth was broken on Nov. 19, and there were several days of rain during the following week. It will probably take but a few weeks to increase the flow of streams enough to greatly improve the conditions of nearly all of the power companies depending upon a water supply. The California Gas & Electric Corporation made good use of its steam reserve plants at Sacramento, San Jose and Oakland during the drouth. The steam plant of the San Francisco Gas & Electric Company in the city also contributed quite an amount of power to help take care of the load on the transmission lines of the corporation with which it is soon to be consolidated. The gas engine reserve plant south of San Francisco is being completed as rapidly as possible. One of the two frequency changers which have been installed has had a test run and current from the transmission lines of California Gas & Electric Corporation can be supplied for the use of the United Railroads system in February, although some further time will be required for the erection of the three large gas engines, owing to a delay at the manufactory.

WINDSOR LOCKS, CONN.—Burdett Loomis and others, of Hartford, Conn., have bought control of the Windsor Locks Electric Light Company and the Enfield Gas Company, and will combine the interests. The new company will add to the electric plant new water wheels and gas engines and will erect a new gas plant.

THOMASVILLE, GA.—Thomasville citizens have voted to incur a debt of $30,000 for the purchase of a municipal light and power plant. The plant to be purchased is that of the Thomasville Electric Light Company.

BELLEVILLE, ILL.—The Belleville Gas & Electric Company has decided to expend about $30,000 in improvements, including a new engine and generator.

LITCHFIELD, ILL.—The Litchfield Heating Company, with a capital stock of $15,000, has been incorporated here by Judge Paul McWilliams, E. F. Sweeney and Dr. G. A. Sahler.

ZIONSVILLE, IND.—The Zionsville Water & Electric Light Company, recently incorporated, is in the market for a full equipment for a water works and electric lighting plant for this city. M. E. Wiesehan is president.

BICKNELL, IND.—Electric light is now being furnished to this city by the Lynn Coal Mining Company, which has installed a large dynamo at its plant near the town. There are 20 streets lamps and many residences and business houses are supplied.

NOBLESVILLE, IND.—The Noblesville Hydraulic Company is preparing to negotiate the sale of bonds, the proceeds to be used in completing the dam across White River, which will furnish power to Noblesville and nearby towns for electric light, etc. The plant when completed will represent an investment of $150,000.

CORNING, IA.—The Corning Light & Heat Company has been incorporated, with a capital of $30,000 by C. R. Munns and others.

AUGUSTA, KY.—Sealed proposals will be received until Dec. 8 for the installation of an electric light plant, as per specifications on file with the clerk of the committee, Mr. J. P. Reese, Augusta, Ky.

ARCADIA, LA.—The plant of the Arcadia Electric Lighting Company was destroyed by fire on Nov. 22.

PORTLAND, ME.—The Portland Lighting & Power Company is having plans prepared for a power plant to be built in this city or the suburbs. The General Electric Company is to furnish the machinery.

BALTIMORE, MD.—At the annual meeting of the Hamilton Water, Light & Power Company the following named officers were elected: President, William McCallister; vice-president, A. G. Struven; secretary, J. Neidhardt; financial secretary, J. C. Toland; treasurer, J. T. Carter.

WOBURN, MASS.—An ordinance has passed first reading in the Board of Aldermen, authorizing the establishment of a municipal lighting plant.

WELLESLEY, MASS.—The town of Wellesley has voted to make a contract with the Edison Electric Illuminating Company for a term of seven years for all the power required for municipal and commercial lighting delivered at the switchboard at the town line. The situation in Wellesley at the present time is peculiar in that the town owns the poles and street wires and the Edison Company owns the commercial wires. The town and the company have agreed upon a valuation of $14,000 for the commercial wires and fixtures which are now the property of the company, and the town has appropriated $32,000 to buy the commercial wires of the Edison Company and to erect a distributing station at the town line. This is the first town to buy its power of the Edison Company, as a municipality, and the contract made is the same as that between the Edison Company and any other wholesale customer.

CROSWELL, MICH.—The taxpayers of the city have voted in favor of bonding for $5,500 for electric lights.

ELK RAPIDS, MICH.—A. E. French has been awarded the contract of erecting the power house for the Elk Rapids Power & Electric Lighting Company.

FLINT, MICH.—Detroit people have purchased the water power rights at Argentine, owned by Derham Bros., W. B. Stiles and L. C. Sutherland. It is stated that the new owners will expend about $200,000 in developing 3,000 horse-power. A new concrete dam and suitable buildings will be erected. One of several objects in view in developing this power will be the furnishing of electric lights and power to Fenton, Durand and also to other towns in the vicinity.

GRANITE FALLS, MINN.—The Council is considering the enlargement of the electric light plant.

LITTLE FALLS, MINN.—The Little Falls Water Power Company contemplates making improvements to its plant.

CROOKSTON, MINN.—The County Board is considering the installing of an independent electric plant for the purpose of lighting the county buildings.

RED WING, MINN.—P. C. Thompson and others, of Detroit, Mich., have purchased the gas and electric light plant here, and will make extensive improvements.

ST. LOUIS, MO.—Surveyors completed the preliminary work preparatory to the construction of a canal connecting Missouri River with Meramac River, for the development of electric power for use in St. Louis. Westinghouse, Chuch, Kerr & Co., of New York, N. Y., are preparing a report on this project.

YERINGTON, NEV.—C. W. Fancher, T. Harris and T. B. Gambel, all of San Jose, intend to erect a large electric power station at Yerington, and if they can secure necessary capital will build an electric railway from Wabuska, near this city, to Mono County, Cal.

DOVER, N. H.—Extensive improvements are to be made to the plant of the Electric Light Company so that concern will be able to supply the increasing demand for light and power.

PASSAIC, N. J.—The question of constructing a municipal electric light plant is reported under consideration here.

NEWARK, N. J.—The City Hall Commission is considering the installation of a lighting plant in the new city hall, at a cost of about $41,000.

PATERSON, N. J.—The Parral Power Company, of Paterson, has been incorporated, with a capital of $500,000 by John L. and Harry E. Griggs and Wm. L. Berdan.

SOCORRO, N. M.—The Socorro Water & Light Company, recently incorporated, has made preliminary surveys. The plan is to install a lighting plant, to be operated by water power furnished by hot springs 288 feet above the power site. The water will afterwards be used to supply the city of Socorro. Frank Owen, of Santa Fe, is general manager.

ARCADIA, N. Y.—The Town Board has granted a franchise to the Niagara, Lockport & Ontario Power Company to furnish electric light, heat and power in this town. This company has also applied for franchises in Lyons and Newark.

FOREST, OHIO.—The Council has awarded a contract to a Sandusky firm to light the city by electricity. The contract is for ten years and provides for 29 arc lights to burn all night, for which the town will pay $2,500 per year. It is stated that the same firm has received the contract to supply Dunkirk with electric lights. Twenty-six arc lights will be furnished in Dunkirk at an annual cost of $80 per light per year on moonlight schedule. The Dunkirk system will be supplied by power from the Forest plant.

WATONGO, OKLA. TER.—The citizens have voted in favor of issuing $6,000 bonds for an electric plant.

HAINES, ORE.—The Hot Springs Electric Light Company has been incorporated, with a capital of $5,000, by W. J. Mays, of Baker City, and J. F. O'Bryan, of Haines.

SCRANTON, PA.—It is stated that the West Scranton Light, Heat & Power Company is preparing to build a new power plant.

PITTSBURG, PA.—Both branches of the Councils have adopted a resolution authorizing the appointing of a committee of seven to inquire into the cost of installing a municipal electric lighting plant, the committee to report at the second meeting of the Councils in January.

BAMBERG, S. C.—The Board of Public Works wants prices on a 90-kw generator, two 100-hp boilers and a 125-hp engine; the plant to consist of 40 arcs and at least 1,000 incandescents. G. M. Dickinson is manager.

SOUTH PITTSBURG, TENN.—This city is negotiating for the purchase of the electric light and water plant. An engineer is estimating the cost of improvements to the same.

JASPER, TEX.—An electric light plant is to be installed at Jasper. Local citizens are interested in the project.

UVALDE, TEX.—The City Council of Uvalde has granted a franchise to J. F. Simpson, W. D. Kincaid and Gus Muller for the installation of an electric light plant at Uvalde.

EL CAMPO, TEX.—It is announced that a company is soon to be organized for the purpose of installing an electric light and power plant at El Campo. The proposed plant is to furnish power for operating irrigation pumps on rice plantations and to operate the machinery of rice mills and other industries as well as to provide lights for the town.

AUSTIN, TEX.—The rebuilding of the great dam across the Colorado River at this place is practically assured. The project is to be undertaken by the Stone & Webster syndicate, of Boston, Mass., under the auspices of the Old Colony Trust Company, of that city. Stone & Webster sent expert hydraulic and electrical engineers here to investigate the feasibilty and practicability of the proposed enterprise. These engineers have made favorable reports. They estimate that the cost of rebuilding the structure will be about $538,000. This dam was built about ten years ago at a cost of $1,000,000. The electric light plant and power house, and water works plant which were erected at a point on the bank of the river just below the dam, cost an additional $600,000. In the spring of 1900 an unprecedented flood in the river swept away a part of the dam and wrecked the power house. In rebuilding the dam it is proposed to utilize the portions of the structure that are still standing. The power house can also be repaired and put in condition for use at comparatively small cost. The ruins of the dam and power house are owned by the city of Austin, but they will be either sold outright or leased to Stone & Webster. There are certain legal matters to be straightened out in connection with the enterprise before the formal transfer of the property can be made.

VERNAL, UTAH.—E. H. Wilson, of Vernal, has filed application at Salt Lake City, for a water right on the Uintah reservation, the purpose being to establish a power plant.

PROVO, UTAH.—Bonds amounting to $91,000 have been sold, the proceeds to be used for an electric light plant and water works. Frank C. Kelsey, Salt Lake City is the engineer.

PRICE, UTAH.—Incorporation papers have been filed by the Grand Canyon Power Company, of Salt Lake City. The capital stock is $100,000, and the officers are: O. S. Buel, secretary and president; H. M. Bowers, vice-president; Geo. Havercamp, treasurer. The company proposes to build a large power plant on Green River.

SALT LAKE CITY, UTAH.—The Inter-Mountain Power Company proposes to construct during the spring three hydro-electric power stations about 17 miles from Salt Lake City. The probable cost of the work proposed is $500,000. Frank C. Kelsey, of Salt Lake City, is the engineer.

BARRE, VT.—An explosion on Nov. 26 practically wrecked the plant of the People's Lighting, Heating & Power Company.

READSBORO, VT.—A number of Readsboro business men have organized a co-operative electric light service and expect to have the lights running soon. F. L. Allen, Dr. Cole, Valentino DaRin, George M. Bemis, H. A. Parsons and H. T. Goodell have formed a stock company and taken out incorporation papers under the laws of the State of Vermont, the title being the Readsboro Electric Light Company.

ODESSA, WASH.—Jas. Shaw, of Harrington, has petitioned for a franchise for an electric light plant at Odessa.

RITZVILLE, WASH.—Articles of incorporation have been filed by the Ritzville Electric Company of Ritzville, with a capital of $50,000. Incorporators: Philip Rowe, W. V. Reinhart, Jr., Geo. H. Tilden, and others.

MADISON, WIS.—It is reported that a $250,000 heating and power plant is to be constructed by the University of Wisconsin.

LA CROSSE, WIS.—The new plant of the Wisconsin Light & Power Company, in this city, was started on Nov. 23. The generators are of the revolving field, turbo-alternator type and were furnished by the Westinghouse Company. Mr. Jacob Cloos, of Milwaukee, was the contractor and constructing engineer.

BAHIA, BRAZIL.—The Bahia Gas & Electric Company has been incorporated in Maine, with authorized capital stock of $3,500,000, to operate systems of gas and electric lights in Bahia, Brazil. The officers given are: President, James S. Hernan, and treasurer, J. L. Brophy, both of Portland, Maine.

TORONTO, ONT.—At a meeting of the shareholders of the Toronto & Niagara Power Company, just held, the agreement between this company and the Toronto & Hamilton Electric Railway was confirmed, granting the Toronto & Hamilton Railway power to build and operate its line between Toronto and Niagara Falls on the Power Company's right of way. The Railway Company, by its agreement, undertakes to construct the line and pay the interest on half the cost of the right of way of the power company. By the arrangement, the development company, among other advantages, has secured the construction of a line which will enable it to control the right of way on its line. Difficulties at present are the gaps at the Humber River, Port Credit, Brotte and Burlington in the feed lines.

VERA CRUZ, MEX.—Alberto Schuler will install a hydro-electric plant on the Minas River, in the Jalacingo district, State of Vera Cruz. The plant will furnish power for mines.

MAZATLAN, MEX.—A hydro-electric plant is to be installed on the Piaxtla River by the Campania Minera Guadaloupe de los Reyes. The plant will cost about $500,000 and will have a capacity of 5,000 horse-power.

SANTA EULALIA, MEX.—Ezequiel Salazar Enriquez, of Chihuahua, will establish an electric light and power plant at Santa Eulalia. In addition to furnishing lights and power for the town and mines at Santa Eulalia, he proposes to convey power to the city of Chihuahua and provide that city with lights.

PARRAL, MEX.—Eugene Davis, of Chihuahua, is at the head of a company which has been granted a concession by the federal government to install an electric power plant 51 miles from Parral. The plant will consist of six units of 500-horse-power each. The power will be transmitted to mines and reduction works of that section.

PARRAL, MEX.—The organization of a company, which will have a capital stock of $10,000,000 is now being perfected for the purpose of installing in this district one of the largest electric power and transmission plants in Mexico. Leopoldo Iwonskey, the general representative of the firm of Stallforth Hermanos, Sucs., of Parral, is promoting the enterprise. American and German capitalists are interested in the project. Mr. Iwonskey has gone to New York and Germany to confer with the interested parties in regard to the details of the project. The contract will soon be let for installing the plant. It will be located between Parral and Minas Nuevas. The power will be generated by mountain streams. A survey has already been made for the proposed plant. Transmission lines will be built to Parral and the numerous mines of the district. The company has just closed a deal for the purchase of an extensive tract of timber land situated adjacent to the site of the proposed plant.

The Electric Railway.

SAN FRANCISCO, CAL.—At a meeting of the directors of the United Railroads of San Francisco, held on Nov. 23, President Holland announced that the control of the United Railways Investment Company, which owns the stock of the United Railroads of San Francisco, having been acquired by other interests, he and Brown Bros. & Company will retire from participation in the management of the company January 1.

CHICAGO, ILL.—The last link in the chain of interurban roads connecting Chicago and Milwaukee was completed Dec. 2 by the opening of the Chicago & Milwaukee Electric Railroad Company's line between Zion City, Ill., and Kenosha, Wis. The trip from Chicago to Milwaukee can now be made over the electric roads for $1.25 and the round trip for $2.15, or less than half the steam railroad fare. The time required from the center of one city to the center of the other is about five hours. A sub-station has been built at Kenosha to supply power at the north end of the line. A new power house, designed to contain 25,000 horse-power in steam turbines is to be built on the beach at Waukegan, replacing the present power house at Highwood. The opening of the line was celebrated by a banquet at Kenosha, Dec. 2, at which the company entertained the mayors and aldermen of the villages through which the road passes, and county officials. The guests were taken to Kenosha by three special trains.

INDIANAPOLIS, IND.—The stockholders of the Columbus, Greensburg & Richmond Traction Company held a meeting in this city on Nov. 24, and elected the following board of directors: H. F. Holland, A. M. Kulin, Indianapolis; Walter McConaha, Richmond; J. T. Clapp, Hartsville; C. M. Brooks and J. G. Barrett, Indianapolis.

NEW ALBANY, IND.—Work has been commenced by the Louisville & Northern Railway and Light Company, to build a system of electric railways in southern Indiana, to reach Louisville over the line of the Louisville & Southern Indiana Traction Company.

VERSAILLES, IND.—A meeting was held in this city last week by the promoters of a traction line from Greensburg to Madison via Versailles. Among those who attended were: C. L. Henry, president of the Indianapolis & Cincinnati Traction line; ex-Governor W. T. Durbin, George A. Ball and others. There is every indication that the road will be built next year.

MADISONVILLE, KY.—The interurban train service between Earlington and this city, and Earlington and Nortonville, which was forecasted some weeks ago, is to be inaugurated as soon as the necessary arrangements can be made.

DETROIT, MICH.—H. A. Everett, of the Everett-Moore Syndicate, states that a proposition is on foot to run cars from Detroit City Hall to Cleveland, via Toledo, and that they will probably be in operation by spring.

NEW YORK, N. Y.—At the annual meeting on Dec. 4 of the Metropolitan Street Railway and the Twenty-eighth and Twenty-ninth Street Railroad the retiring boards of directors were reelected.

GENEVA, N. Y.—The Geneva, Phelps & Newark Railroad Company has been formed to operate an electric railway 15 miles long, from Geneva to Newark, Wayne County, with a capital stock of $400,000. The directors are S. W. Hayes, Geneva; S. S. Partridge, Phelps, and E. K. Burnham, Newark.

CINCINNATI, OHIO.—The Interurban Railway & Terminal Company has reelected the present officers with the exception that L. T. Anderson was chosen a director in place of J. M. Kennedy, Jr., who has retired. The company has decided to abandon its generating station at South Lebanon and move the two 800-hp units in that station to the station at Coney Island, increasing the capacity of that plant to 6000 hp, thus centralizing the power equipment for its three roads, embracing 101 miles of track. To accomplish this, the company will build a transmission line 8 miles across country to take care of its Rapid Railway division formerly supplied by the South Lebanon station.

ROOSEVELT, OKLA.—The Wichita Mountain Traction Company, with headquarters at Roosevelt and Hobart, has been chartered with a capital of $250,000 for the purpose of building an electric railway from Roosevelt to Apache, a distance of 50 miles, and costing $250,000. The incorporators are: W. R. McKnight, E. A. Coulter, C. L. Johnson and Guy H. Parker, of Roosevelt; John A. McKeene, of Hobart.

CORPUS CHRISTI, TEX.—Steps have been taken to organize a company to build and operate an electric railway to connect Corpus Christi with the Alta Vista resort, situated about three miles from town.

SAN MARCOS, TEX.—Bids are being received for the construction of the interurban electric railway between the towns of San Marcos and Luling by the San Marcos Valley Interurban Railway Company. Judge B. G. Neighbors, of San Marcos, is secretary of the company.

HOUSTON, TEX.—The project of building an interurban electric railway between Houston and Galveston, a distance of about 51 miles, has been revived. A number of wealthy business men and bankers of the two cities are interested in the matter and it is believed that the consummation of the project is now assured. Among those interested are J. O. Russ, H. C. House, O. T. Holt, H. Masterson, Hyman Levy, all of Houston; W. J. Moore, of San Antonio and F. L. Dana, of Galveston.

TORREON, MEX.—The Torreon & Lerdo Electric Railway Company has purchased the electric light plant at Torreon. It is reported that the same company is negotiating for the purchase of the electric street railway system in Torreon. The owners of the latter company recently announced that they would soon increase its capital stock from $100,000 to $250,000, the additional capital to be used in extending the system.

New Industrial Companies.

THE GREENWICH ELECTRIC COMPANY, of New York, has been incorporated with a capital stock of $5,000 by J. T. Ramsay, W. C. Ward and E. Tobieson, New York.

THE DARCHE ELECTRIC CLOCK COMPANY, of Chicago, has been formed, with a capital stock of $40,000. The incorporators are Frank W. Jansen, Augusta Y. Jansen and C. D. Fahrney.

THE BABCOCK ELECTRIC CARRIAGE COMPANY, of Buffalo, N. Y., has been formed with a capital stock of $100,000. The directors are F. A. Babcock, F. L. Bapst and Harry Yates, of Buffalo.

THE FRANCO-AMERICAN ELECTRIC COMPANY, of New York, has been incorporated with a capital stock of $50,000. The directors are B. Baunstein, Hoboken, and Simon Baunstein and J. Ochs, New York.

THE L. W. GILLESPIE COMPANY has been incorporated at Marion, Ind., with $15,000 capital stock, to manufacture gasoline engines and electrical supplies. The directors are Arthur F., Leonard W., and Ella M. Gillespie.

THE BLACKALL & BALDWIN COMPANY, of New York, has been incorporated to manufacture electric motors. The capital stock is $50,000 and the directors are: A. S. Adams, W. H. C. Lee and F. S. Blackall.

THE H. P. METER COMPANY, of New York, has been incorporated to manufacture electric meters. The capital stock is $100,000, and the directors are: H. Hertzberg and W. P. Snyder, of Brooklyn, and H. I. Bernard, of New York.

THE NORTHERN TEXAS ELECTRIC COMPANY has been formed at Portland, Me.; capital, $5,000,000. President, L. Barton; treasurer, J. H. Ridge. Directors as above and E. L. Bodge, A. W. Tolman, J. H. Pierce, Scott Wilson and W. K. Neal, all of Portland.

THE OAKMAN MANUFACTURING COMPANY, of New York, has been incorporated to manufacture gas and electrical apparatus. The capital stock is $50,000, and the directors are E. N. Oakman and W. S. Dorman, New York, and F. H. Oakman, Shelburne Falls, Mass.

Legal.

MARKET QUOTATIONS AND BUCKET SHOPS.—In the case of the Hammond Elevator Company vs. the Western Union Telegraph Company, the Indiana Supreme Court reverses the judgment of the lower court and decides that bucket shops cannot compel telegraph companies to deliver market quotations to them.

NO TELEPHONE OPPOSITION IN CINCINNATI.—By a recent decision of the Ohio Supreme Court the case of the Queen City Telephone Company against the City of Cincinnati was unfavorable to the Queen City Company. The company attempted to get a franchise through the Probate Court, the City Council failing to act in the matter. The Supreme Court affirms the judgment of the Circuit Court, which was against the Queen City company.

CONDEMNING LANDS FOR CENTRAL STATIONS.—Justice Wright, of the Supreme Court of New York, according to a despatch from Utica, has rendered a decision upholding the constitutionality of the law which gives to electric light and power companies the right to condemn lands which may be required in the business of furnishing municipalities with light and power. The East Creek Electric Light & Power Company sought to acquire the lands of Norman Loucks and asked for the appointment of a commission to assess the damages. Loucks resisted, and attacked the constitutionality of the statute. Justice Wright holds that the Legislature has the power to invest in companies providing municipalities with a supply of electricity for power and lighting the same rights that are held by companies engaged in furnishing cities and towns with water.

STEAM PIPE COVERING.—An important patent suit over steam pipe covering has been begun in the United States Circuit Court. The complaint charges conspiracy in connection with the alleged infringement and the amount of damages aasked, $600,000, is unusually large. Edward K. Jones, the attorney acting for the Keasby & Mattison Company, of Ambler, Pa., has filed the complaint. The defendants, six in number, are also manufacturers. They are Jacob F. Schoellkopf, Jr., of Buffalo; William S. Gray, of New York City; William T. Mayer, of Albany; C. P. Hugo Schoellkopf, of Buffalo; and Henry T. Pierce and Thomas Keeney, of Hancock, N. Y. Jacob F. Schoellkopf, Jr., is a member of a corporation capitalized at $3,000,000 and doing business at 100 William Street. It is alleged that the six firms entered into a conspiracy whereby the plaintiff lost many customers and was deterred from increasing his business. The Keasby & Mattison Company is a manufacturer of a patented covering for steam pipes. It is alleged that the defendants conspired to infringe the patent prior to its expiration and that they made and sold an infringing product of the plaintiff's patent, greatly to the damage of the Keasby & Mattison Company. Usually infringement cases are tried in equity, but because conspiracy is alleged in this case and a definite amount of damage named it will be tried before a judge and jury.

Obituary.

W. H. EDGAR.

MR. W. H. EDGAR.—The death is noted on November 26 of Mr. William H. Edgar, president of the Dearborn Drug and Chemical Works, of Chicago, and residing at 4642 Drexel Boulevard, who died at the Arlington hotel, Hot Springs, Ark., Sunday night, after an illness of six weeks. Mr. Edgar was born in Chicago Nov. 25, 1865. He was a member of the Chicago Athletic Association of Chicago, and the Bohemian Club of San Francisco. He belonged to Dearborn Lodge A. F. and A. M., Apollo consistory, Oriental consistory and Medinah Shrine. He was also a member of Los Angeles Lodge of the Benevolent and Protective Order of Elks. He was married to Miss Elizabeth Winthrop, of Davenport, Iowa, four years ago. He leaves a widow and two sisters, Mrs. Carrie Edgar Wallace and Miss Catherine J. Edgar, and his mother, Mrs. Lucy M. Edgar, all of 4240 Champlain Avenue, Chicago. Mr. Edgar, through the energetic pushing of and large demand for his boiler compounds, and his active interest in electrical work, has become very widely known among electric light and street railway managers. He and his company participated in the various conventions, and in the course of years he had built up a circle of friendship and acquaintance far beyond the ordinary. He was a typically successful western business man. The funeral took place at Chicago on November 29.

Personal.

MR. CHARLES T. YERKES has arrived in New York from London, but has been confined to the Waldorf by a severe cold. His condition has greatly improved this week.

MR. HORACE ANDREWS.—It is reported that Mr. Charles T. Yerkes, who is now in this country, has offered the presidency and management of the London Underground Railway to Mr. Horace Andrews, president of the Cleveland Electric Railway.

MR. JOHN A. HILL, president of the Hill Publishing Company, publisher of the *American Machinist* and *Power*, has been elected president of the American Trade Press Association, in succession to Mr. James H. McGraw. The annual dinner was given on December 1 at the Hardware Club, New York, when Mr. Hill made a virile address on aspects of technical journalism.

MR. W. B. GRAHAM.—Inspectors and officials of the Brooklyn Rapid Transit Company have been notified that the post of Superintendent of Surface Lines has been abolished, and that W. B. Graham has given up his connection with the company. A new place has been created, that of Assistant General Superintendent. The official selected is Mr. Dow S. Smith, with W. O. Wood, formerly of the elevated lines, to assist him, with Mr. L. V. Smith to be superintendent of the elevated division of the service.

MR. W. J. SHERWOOD, who has served as chief clerk of the general superintendent's office of the Brooklyn Rapid Transit Company under three general superintendents, has accepted a place as assistant to the general manager of the Mexico City Tramways. Mr. Sherwood will leave for Mexico on December 14. Beginning his railroad work in the office of the train dispatcher of the New York Central Railroad, some twelve years ago, Mr. Sherwood became connected with the Brooklyn Rapid Transit Company in 1895, and

has been with that corporation continuously, with the exception of a short period with the Public Service Corporation of New Jersey.

MR. W. W. WHEATLY, president of the Mexico City Electric Tramways, Ltd., accompanied by Mr. Paul H. Evans, the chief engineer and purchasing agent, is visiting New York City for a brief holiday and to look up some business matters. Mr. Wheatly states that the Mexican Electric Tramways has made a contract to receive hydraulic power from the Mexican Light & Power Company's hydraulic plant at Necaxa, where there are about 40,000 hp under process of development, with an additional 40,000 hp held in reserve. The amount contracted for at first is about 5000 kw, but this must be increased during the next few years to 8000 kw. According to Mr. Wheatly, one special mission here at this time is to purchase the electric apparatus for the installation of the four new sub-stations which are to receive the alternating current from the Necaxa Company's plant. At the same time he is taking advantage of his presence in New York to make purchases of a large quantity of other materials.

MR. G. W. LAWRENCE.—The Greenfield (Mass.) Electric Light and Power Company has secured as its superintendent Geo. W. Lawrence, a thoroughly trained electrical engineer. A. J. Doolittle, who has been superintendent and treasurer, has resigned the former position, but retains the latter. The change is purely voluntary on Mr. Doolittle's part, he feeling that a younger man should come into the business and relieve him of a part of his duties. Mr. Doolittle continues in the employ of the company. Mr. Lawrence is 30 years old. He is a graduate of the University of Maine, and was for three years with the General Electric Company at its Schenectady plant. After that he became superintendent of the electric and steam plant of a large mining company that was operating in Mexico. Since that time he has been with the General Electric Company at Boston, and was for the past two years the foreman of construction with the General Electric Company's Boston office, having charge of the setting up and installation of the machinery sent out from that office. He set up for the General Electric Company the new machinery at Gardner Falls, so that he is familiar with its operation.

Trade Publications.

WINDOW LIGHTING.—The H. T. Paiste Company, Philadelphia, Pa., has issued bulletin No. 27, dealing with Fielding receptacles, rosettes and weather-proof socket plugs for window lighting and general decorative effects.

CRUSHING ROLLS.—The Allis-Chalmers Company, Milwaukee, Wis., has issued catalogue No. 128, treating of crushing rolls for crushing rock, coal, salt and ores of all descriptions. The catalogue contains 56 pages, which are devoted to a detailed description of the various machines.

PLUG CUT-OUTS.—Flyer No. 2167 of the General Electric Company, Schenectady, N. Y., illustrates a complete line of plug cut-outs for 125 and 250-volt circuits. The cut-outs are compact in construction and present a neat appearance. They are equipped with substantial porcelain covers which protect all metal parts and remove the possibility of accidental short circuits.

ELECTRIC POWER IN FACTORIES.—The Stanley-G. I. Electric Manufacturing Company, Pittsfield, Mass., has issued as bulletin No. 144 a reprint of an article by Mr. A. W. Henshaw on "Electric Power in Factories," which appeared in the ELECTRICAL WORLD AND ENGINEER, March 18, 1905. The bulletin is well illustrated, numerous views being given of machines built according to the S. K. C. system.

ELECTRIC ELEVATORS.—The Otis Elevator Company has issued a well-illustrated catalogue dealing with elevators for all services. In addition to describing the various devices which serve to make up a complete elevator equipment, the catalogue gives views of numerous elevators now in use of both the electric and hydraulic types. Views are also given of special elevator equipments such as inclined railways and escalators.

POLYPHASE WATT-HOUR METERS.—Bulletin No. 1074 of the Fort Wayne Electric Works, Fort Wayne, Ind., describes a complete line of polyphase induction watt-hour meters. Each meter might be considered as two single-phase meter fields operating upon a single rotating element in such a manner as to record upon a single register the combined energy in watt-hours which is being used in all the phases of the multiphase circuit to which the meter is connected.

ELECTRIC BOTTLE WASHER.—The Emerson Electric Manufacturing Company, St. Louis, Mo., has issued bulletin No. 3,953, devoted to motor-driven bottle washers for cleaning bottles and arc lamp globes. This device is adapted for the use of small dairies and carbonating and bottling establishments which have a considerable number of bottles to clean, but where the volume of work is not sufficient to warrant the installation of an expensive automatic bottle-washer.

STEAM TURBINES.—The General Electric Company, Schenectady, N. Y., has issued a well-executed catalogue designated as No. 9137-2, showing numerous views of Curtis steam turbines now installed. It is stated that the first machine was put into commercial service in the power house of the General Electric Company, on October 1, 1902. Curtis turbines now in daily commercial service have a rated capacity of over 135,000 kilowatts, and an overload capacity of over 202,500 kilowatts.

POLYPHASE INDUCTION MOTORS.—Bulletin No. 359, of the National Electric Company, Milwaukee, Wis., describes a complete line of polyphase induction motors in capacities from 1 hp to 75 hp. Each motor is provided with distributed primary windings on the stator, and squirrel-cage secondary windings on the rotor. The frame is so constructed as to afford ample ventilation. The motor is placed in operation by means of variable ratio transformers which supply reduced e.m.f.s. to the motor circuits.

MOTOR-DRIVEN AIR COMPRESSORS.—The National Electric Company, Milwaukee, Wis., has issued bulletin No. 363, dealing with stationary and portable motor-driven air compressors for continuous and intermittent service. The motors driving these compressors are of the series type, and are mounted directly on the frame of the compressors which they drive through herring-bone gears and pinions. It is stated that the noise of the gearing is unnoticeable. These compressors have been designed particularly for use with portable pneumatic tools.

THE COMFORTS OF ELECTRICITY AND GAS.—The Denver Gas and Electric Company has issued some attractive advertising matter in the form of two booklets dealing with the comforts to be derived from gas and electricity, respectively. Descriptions are given of cooking ranges, water-heaters, room heaters, grates and water stills operated by gas, and numerous electric devices, including call bells, heaters, laundry irons, chafing dishes, motors, elevators, telephones, fans, telegraphs, lamps, automobiles and electric signs. These booklets are well illustrated and should prove effective business getters.

COAL HANDLING MACHINERY FOR MINES.—The Jeffery Mfg. Company, Columbus, Ohio, has issued Catalogue No. 20 illustrating machinery specially designed for handling coal at the mines. Views are given of direct-current generators, electric locomotives of the single-unit and double-unit types, and of the single-end and center control and also electric gathering locomotives, which operate beyond the range of the trolley wire. Illustrations are also shown of electric coal cutters of the long-wall, chain and shearing types. The major portion of the catalogue is devoted to mechanical coal conveying devices.

THE LIVING AGE occupies a field peculiarly its own. It gives sixty-four pages every Saturday of selections from the best and most popular English periodicals, and is almost indispensable to any one who wishes to keep informed upon public affairs and current discussion. The sources from which its material is taken represent an annual cost price of nearly two hundred dollars. The magazine serves an exceedingly useful purpose by sifting out from week to week whatever in English periodicals an intelligent American reader cares most for, and reproducing these articles without abridgment. Fiction, essays, travel sketches, poetry, critical and biographical papers, literary and art articles, and much else besides, will be found in the magazine. The subscription price is six dollars a year, but a trial subscription of three months, thirteen numbers, may be had for one dollar.

INDUCTION MOTORS.—Bulletin No. 1072 of the Fort Wayne Electric Works, Fort Wayne, Ind., is devoted to single-phase induction motors. In the three forms of motors described in this bulletin, three distinct principles are involved in the starting operation. Form A motors, which are furnished only in the one-fourth and one-half horse-power sizes, are of the hand-starting type. Form B motors are supplied with an auxiliary starting winding so proportioned in resistance and reactance as to allow a current to flow through its coils which is sufficiently displaced in phase from that of the main winding to produce an adequate starting torque. The principle of operation of Form C motors, which are produced in capacities from one to 15 hp. inclusive, is entirely different from either of the two previously mentioned. The winding upon these motors is similar to that of a polyphase motor, but in addition a condenser is connected between a given point of the winding and one of the terminals so as to throw the current in one portion of the winding out of phase with that in the other portion. The condenser provided with this motor is sealed in an air-tight and moisture-proof case, and is assembled within the sub-base of the motor. It is permanently connected with the motor circuits. Instruction book No. 3022 of the same firm gives much practical information concerning the installation, operation and care of induction motors, treating particularly motors of the polyphase type.

News of the Trade

THE LOWE ELECTRIC COMPANY has removed its store to 54 Vesey Street, New York City. It is located between Church and Greenwich Streets.

TO ENLARGE PLANT.—The High Voltage Porcelain Company of New Lexington, O., is doubling the capacity of its plant in order to keep pace with its rapidly increasing business.

THE WESTINGHOUSE ELECTRIC & MFG. COMPANY has perfected a new line of three-phase core-type transformers for 60-cycle circuits. One of these transformers may be used where three-phase transformation is to be made, instead of two or three of the single-phase type. They are self-contained units of compact construction, and are generally easier to install, and reduce the complexity of wiring between the transformer and the apparatus which they are to supply.

PRINTING PRESSES.—Because of the fact that the Westinghouse Electric & Mfg. Company make the largest units required for the production and transmission of electricity, comparatively few people know that in the same works at East Pittsburg are manufactured also the smallest units to meet the needs of printing establishments and similar lines of industry. It is a matter of considerable gratification to the company to see the favor with which its motors for the printing industry have been received. There have very recently been closed three contracts aggregating in the neighborhood of 400 motors, and the company is in position to undertake the equipment of printing establishments with machines from the smallest to the largest sizes.

WIRELESS AT THE SHOW.—Among the features of the Electrical Show, to be held in Madison Square Garden from December 12 to 23, will be a wireless bulletin service which will be maintained in the Garden through the exhibition. News items and happenings on the various steamships equipped with the De Forest wireless apparatus will be transmitted from the exhibit to the surrounding cities and to vessels at sea. Among the wireless apparatus to be shown will be the mechanisms used in the Japanese-Russian war and demonstrations will be made of the apparatus now in use on the American merchantmen and battleships. The exhibit will include a wireless automobile which is an electrically propelled motor car equipped with sending and receiving apparatus. These cars have been used for reporting sporting events and are intended for this purpose as well as for army use. The machine to be exhibited has been successfully used in reporting the curb brokers' sales and other items of news interest in New York City.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED NOV. 28, 1905.

[Conducted by Rosenbaum & Stockbridge, Patent Attys., 140 Nassau St., N. Y.]

805,439. LIGHTNING ARRESTER; Arthur J. Berry, Marion, Ohio. App. filed Feb. 25, 1905. Two metal tubes are adapted to be supported in co-axial relation and parallel to the usual telephone wire, and are respectively connected to the wire and to ground so as to produce a spark gap between them.

805,448. MAGNETIC SEPARATOR FOR ORES; Henry F. Campbell, Melrose, Mass. App. filed Jan. 20, 1904. An inclined table has a plurality of magnets rigidly supported above its surface and has a hammer or knocker for jarring the ore beneath the magnets. The entire table and magnets are adjustable to vary the inclination.

805,499. ELECTRIC DRILL; Stephen D. Stoycheff, Toledo, O. App. filed June 26, 1903. The drill has a cylindrical metal casing with motor coaxially mounted therein and operating a train of gears including a friction clutch for rotating the drill.

805,501. METHOD OF PRODUCING CHEMICALS IN ELECTRIC FURNACES; Edward R. Taylor, Penn Yan, N. Y. App. filed Jan. 25, 1902.

805,502. METHOD OF PRODUCING CHEMICALS IN ELECTRIC FURNACES; Edward R. Taylor, Penn Yan, N. Y. App. filed June 9, 1902.

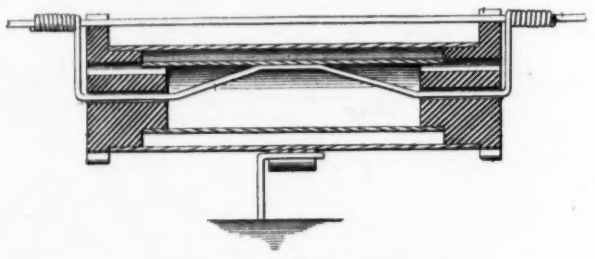
805,505. AUTOMATIC REGULATOR FOR ELECTRIC CIRCUITS; Montgomery Waddell, New York, N. Y. App. filed June 28, 1904. A system of regulating dynamos in which the fields thereof have a principal and a reverse wound section in series with each other and together in shunt with the armature. An automatic regulator comprising a variable resistance device is placed in shunt with the principal field magnet coil.

805,509. ELECTRIC CUT-OUT; Willes P. Wright, Blandinsville, Ill. App. filed June 13, 1904. Details of construction of a cut-out adapted to an ordinary gas chandelier. A porcelain casing has four swinging metal arms therein, the outer ends of which are joined by fuse wires, and the inner ends of which are respectively connected to the lamps and to the supply mains.

805,547. ARMATURE FOR ELECTRICAL MACHINES; William T. Hensley, Boundbrook, N. J. App. filed Mar. 25, 1905. In order to secure more efficient ventilation of the armature coils, the patentee provides small flat strips which lie upon the surface of the usual coils and have shoulders for maintaining the discs in spaced apart relation.

805,557. ELECTRIC CURRENT GENERATOR; William Kaisling, Chicago, Ill. App. filed May 31, 1904. The magneto has a two-part commutator with end plates electrically connected to the respective segments. Separate binding posts are provided for obtaining a rectified current from the commutator or an alternating current from the end plates.

805,568. TROLLEY BASE; Henry R. Lockhart, Westmount, Canada. App. filed July 23, 1904. The trolley pole is hinged to a horizontal arm



805,439.—Lighting Arrester.

swiveled upon the car and which has upon it a spring with link connections to the pole for holding the latter against the usual conductor.

805,572. TROLLEY WHEEL; Alexander H. Mathesius, Brooklyn, N. Y. App. filed May 24, 1900. The tread portion of the trolley wheel is rotatable separately from the side flanges so that the different surface speeds of the tread and flange in running upon the wire will be avoided.

805,574. ELECTRIC GAS LIGHTER; Joseph Mlada, Manitowoc, Wis. App. filed Mar. 21, 1905. The turn cock for a Welsbach burner is directly beneath the mantle and has an arm adapted to make electrical contact when the gas is turned on.

805,598. TELESCOPIC RAMMER MOTOR; Alfred A. Thresher, Dayton, O. App. filed July 24, 1905. Details of construction of a telescopic rammer in which the motor is built into a frame and has a chain connection with the usual operating shaft.

805,619. ELECTRIC SIGNALING SYSTEM; William S. and Arthur S. Aungst, Alliance, O. App. filed Mar. 20, 1905. A system for utilizing the usual telephone wires for a fire alarm system. When the fire alarm circuit is made, a special lamp on the switchboard is lighted so that the telephone operator plugs in the fire alarm station.

805,650. PANEL BOARD; Hubert Krantz, New York, N. Y. App. filed Dec. 29, 1904. In order to economize space, and generally to provide a neater and more safe fuse plug system for a panel board, the patentee places the fuse plug receptacles directly over the usual bus bars and has special metallic cross strips for making the necessary circuits.

805,665. CONDUIT; Daniel E. Reagan, Terre Haute, Ind. App. filed Mar. 10, 1905. The usual concrete conduit sections have aligned holes and a pin with pointed ends and side wings is adapted to fit into the holes so as to hold the sections in alignment.

805,714. VISIBLE AND AUDIBLE SIGNAL; John L. Creveling, New York, N. Y. App. filed Oct. 27, 1900. A fog signal apparatus in which a lamp and a whistle may be operated by wireless telegraphy. The alarm circuit is closed only after a predetermined time, so that the apparatus will not respond to ordinary wireless messages but only to a special wireless signal of long duration.

805,725. CONTROLLING DEVICE FOR ELECTRIC GENERATORS; Moritz von Hoor, Friedrich Reinitz and Leopold Stark, Budapest, Austria-Hungary. App. filed April 17, 1901. (See Current News and Notes.)

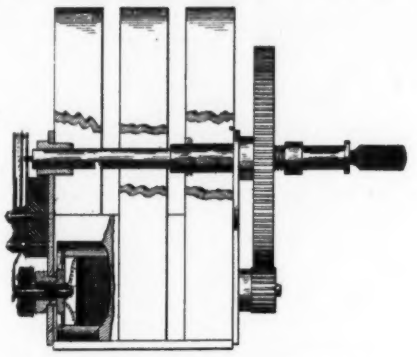
805,735. REAR END CONTACT TELEGRAPH KEY; Samuel B. Lefley, Florinel, Pa. App. filed Aug. 26, 1903. The telegraph key is pivoted by a pair of rocking knife blades and the contact is made at the rear end of the lever. The purpose is to minimize friction and give a greater flexibility.

805,783. ELECTRIC FURNACE; John S. Dorian, Niagara Falls, N. Y. App. filed March 27, 1905.

805,788. ELECTRIC STRAIN INSULATOR; Samuel L. Foster, San Francisco, Cal. App. filed Jan. 16, 1905. The usual porcelain insulating block is enclosed in a socket shaped casing to which one of the strain connections is made, while the other strain connection passes through an axial hole in the insulating block having a nut within the casing to engage the same.

805,795. X-RAY TUBE; John O. Heinze, Jr., Lowell, Mass. App. filed Mar. 16, 1905. In order to avoid injury to the operator by X-rays the anode plate within the vacuum tube is enclosed within an iron hood which permits passage of the rays only in the desired direction.

805,827. RAILROAD SIGNAL CIRCUIT; Eugene W. Vogel, Chicago, Ill. App. filed Sept. 20, 1901. The track rails are divided into insulated



805,557.—Electric Current Generator.

sections and are energized by direct currents which operate local magnets for the usual signal circuits.

805,854. MAGNETIC ORE SEPARATOR; Eric Hedburg, Joplin, Mo. App. filed Jan. 15, 1904. The ore is led through a vertical annular passage in which are successively presented annular pole faces of varying strength to which adhere the magnetic particles. The magnets are continuously rotated so as to scrape off and remove the adhering particles.

805,856. BLOCK SYSTEM FOR RAILROADS; Albert N. Ireland and John T. Reese, Sioux City, Ia. App. filed Apr. 6, 1905. Details of a block signal system in which springs are placed along the roadway and make electrical connection with a pivoted arm upon the locomotive fender so as to ring an alarm circuit within the cab in case the semaphores are at danger position.

805,874. AUTOMATIC FIRE EXTINGUISHER SYSTEM; James G. and John D. Nolen, Toledo, O. App. filed Sept. 11, 1902. All the fire plugs in an office building have an attachment for transmitting a signal to the underwriter's office when the water is turned off. Each signal operates like an ordinary messenger call so as to indicate the particular plug shut off.

805,879. ILLUMINATING DEVICE; Adolph Richter, New York, N. Y. App. filed Feb. 24, 1905. The lamps are supported on a frame adapted to rotate on a vertical axis. A motor is provided for rotating the axis so as to give a more diffused illumination.

805,901. TELEPHONE-EXCHANGE SYSTEM; Henrik Thore Cedergren, Stockholm, Sweden. App. filed Jany. 28, 1902.

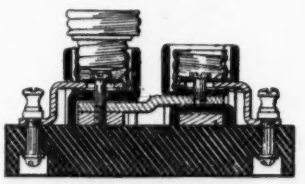
805,952. ELECTRICAL MUSCULAR EXERCISING MACHINE; Robert O. Hammond, Buffalo, N. Y. App. filed May 23, 1905. The usual exercising straps are led around the driving pulley of a magneto generator which imposes the necessary resistance and at the same time gives the operator an electrical treatment.

805,968. JUNCTION BOX; Edwin T. Greenfield, Monticello, N. Y. App. filed Oct. 24, 1904. The junction box has conical openings for the usual terminals and corresponding plugs are adapted to be clamped therein so as to secure the wires in place.

806,006. PROCESS OF MANUFACTURING CALCIUM; Otto Ruff, Berlin, and Wilhelm Plato, Colberg, Germany. App. filed Jan. 20, 1903.

806,009. AUTOMATIC MOTOR STARTING RESISTANCE; Ralph Scott, Wilkesbarre, Pa. App. filed June 15, 1904. The starting arm is guided to move longitudinally with a cylindrical casing under the influence of a solenoid magnet, and a dash pot is provided for limiting the speed of the movement.

806,018. ELECTROMAGNETIC RELAY OR SOUNDER; Thomas M. St. John, New York, N. Y. App. filed Apr. 12, 1905. The magnet is



805,650.—Panel Board.

held horizontally above a resilient board upon which is an armature extending into proximity to the pole piece of the magnet.

806,035. ELECTRIC SIGNALING AND ELECTROPNEUMATIC TRAIN CONTROL SYSTEM; John A. Whyte, Toronto, Canada. App. filed Sept. 2, 1904. Trolleys are laid adjacent to the usual track rails and in case another train is upon the same block, an electro-pneumatic system within the engine cab serves to notify the engineers.

806,039. ELECTRIC HEATER FOR OIL WELLS. James E. Williamson and Charles E. Collins, Allegheny, Pa. App. filed Jan. 23, 1896. Comprises a cylindrical box having a heat coil inside which is attached to the usual oil well rope and lowered into the hole to heat the same for any desired purpose.

806,052. RECEIVER FOR WIRELESS TELEGRAPHY; Henry S. Blackmore, Mt. Vernon, N. Y. App. filed May 8, 1901. A detector comprising a body of selenium is enclosed within a casing of aluminum which forms one terminal of the detector. The aluminum will not permit the passage of light rays to affect the selenium, but only the invisible rays of the wireless emanations.

806,067. ELECTRICAL SIGNALING MECHANISM; David H. Coker, Piedmont, Ala. App. filed Dec. 13, 1904. A lever is pivoted within a box and has at one end a screen which makes a signal through an opening in the box, and at the other end an operating magnet.